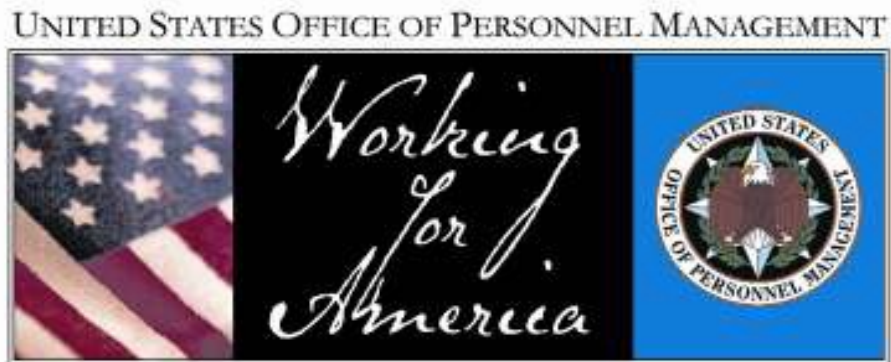


The United States Office of Personnel Management



Human Resources Line of Business Modernization Roadmap VERSION 1.0

December 8, 2011

Human Resources Line of Business Modernization Roadmap

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HR LOB Modernization Roadmap Executive Summary

The Administration's focus on the management of human resources has been unprecedented. Fully recognizing the critical importance of a motivated, competent, efficient, and effective workforce supported by modern, well-managed information technology, the Office of Personnel Management (OPM) – in partnership with the Office of Management and Budget (OMB) – has been developing and promulgating policy and regulatory guidance to agencies on improving the management of Federal HR. This transformation effort is being implemented in sync with the overarching governmentwide IT Reform initiative mandated by the United States Chief Information Officer at OMB. The key principles and recommendations contained in OMB's 25 Point Implementation Plan to Reform Federal Information Technology Management are included in this Modernization Roadmap and will be followed as the Roadmap strategies are being implemented.

The Modernization Roadmap outlines the current state of Federal Human Resources Information Technology (HRIT), the desired future conceptual architecture of Federal HRIT, the high level roadmap to reach the future conceptual architecture, and funding strategies to support achievement of the roadmap.

Federal agencies currently approach HRIT in various ways. Some agencies manage their HRIT application portfolios at the enterprise level and are realizing the benefits – cost savings and efficient information sharing – that enterprise-wide HRIT affords. Other agencies allow duplicative systems, operating and maintaining multiple systems to support various business functions. Many of these agencies have not standardized their business processes and are delaying their migration to a Shared Service Center until after their agency-level standardization has been completed. Migration to an SSC could accelerate their consolidation and standardization.

Current Federal HR applications vary widely in terms of size, scope, complexity, and implementation technology. Some HR applications provide best of breed HRIT functionality to their customer constituencies. Others are quite old and outdated requiring multiple work-around business processes to compensate for system and interface deficiencies. Some applications were built to accommodate multiple agencies' requirements. Many however are proprietary systems that were originally developed for the narrowly defined needs of a single agency or bureau. While some system owners have begun efforts to integrate their systems and are employing standardized data exchange formats and processes, most of these applications were not created with integration in mind. They were developed when simple point-to-point interfacing was the only available means for data exchange, integration concepts were unproven, and there was no expectation that application systems should be interoperable.

The future conceptual architecture reflects a future state in which HR information technology operates seamlessly and efficiently to address individual agency and

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governmentwide needs and requirements in a modern, standardized, cost-effective manner. In this environment, HR technology solutions interact via an interoperability/integration facility that provides for a strong degree of information sharing and minimal data and logic redundancy across applications. The future architecture promotes HRIT resource sharing and encourages solution providers to virtualize their offerings on the cloud to the extent possible.

The HR LOB Modernization Roadmap provides several key recommendations designed to modernize HR information technology:

1. Modernize HRIT systems to ensure they meet the expectations of an expanding customer base and adhere to modern technology standards.
2. Encourage customer agencies to move away from localized resources and move toward shared and virtual solutions while preserving options for and access to modern, innovative solutions.
3. Develop governmentwide HR data standards that provide a blueprint for the data exchange that is an essential element of interoperability.
4. Acquire and implement an interoperability and integration capability that will be used by system owners and service providers to achieve interoperability across systems and services.
5. Establish the HRIT Innovation Center to share insight around innovative HRIT and make recommendations on how innovation can be applied to HRIT solutions and solution delivery.
6. Work with OMB on flexible budget approaches and help guide HRIT project sponsors in leveraging these flexible budget approaches to fund HRIT modernization and improvement projects.

The HR LOB Modernization Roadmap is a strategic document intended to help drive the future direction of human resources information technology by presenting sound ideas for effective and efficient management of Federal HRIT. The modernization strategy inherent in this Roadmap will provide flexibility for solution providers to build and deliver the applications that the marketplace needs while remaining consistent with the principles of modularity, openness, flexibility, security, and effective management of information as a strategic asset.

The Roadmap has been developed by the HR LOB program office at the Office of Personnel Management as the managing partner for this governmentwide initiative. With the help of HR LOB stakeholders, the Modernization Roadmap will continue to evolve and will be revised over time. It will be updated to accommodate technology innovations and the changing Federal HRIT landscape. Stakeholder input will be critical to this evolution to ensure the Modernization Roadmap remains broadly applicable, relevant, and executable.

1 Introduction

1.1 Purpose of the HR LOB Modernization Roadmap

The purpose of the HR LOB Modernization Roadmap is to provide a plan for governmentwide HRIT modernization that helps achieve the vision of the HR LOB. The HR LOB does not own or have operational responsibility for any systems or applications. It provides guidance to SSCs and agencies regarding HRIT modernization and delivery. This document is intended to provide such guidance. It focuses on describing modernization at a conceptual level of detail and it offers broad steps for achieving the interoperability and integration of HR information technology. This will be key to ensuring alignment and interoperability across HRIT systems governmentwide.

The intended audience of this document is:

- The HRIT stakeholder community as the consumers and providers of HRIT
- Office of Management and Budget (OMB) as the approval body and regulator for Federal IT

Over time, agencies will be expected to deliver their own plans that are consistent with this Roadmap. According to OMB's passback requirements for FY2011, beginning in FY 2010 all development, modernization or enhancement (DME) and/or operations and maintenance (O&M) technology refreshment activities must implement agency Chief Information Officer-approved modernization roadmaps.

1.2 HR LOB Overview

The Office of Personnel Management (OPM) launched the HR LOB initiative in 2004. The HR LOB is intended to help the Federal government realize the potential of electronic government by significantly enhancing human resources service delivery within the Executive Branch. The HR LOB Concept of Operations (CONOPS) describes a service delivery model in which designated core HR services relative to human resources information systems (HRIS) and payroll operations move from agencies to shared service centers (SSCs).

Under the HR LOB CONOPS, agencies must obtain HRIT services for the core functions of Personnel Action Processing, Benefits Management, and Compensation Management (payroll operations) from an SSC. At a minimum, SSCs must provide HRIT services for the core functions of Personnel Action Processing and Benefits Management. Additionally, SSCs may also offer core Compensation Management (payroll operations). Other non-core functions as defined by the HR LOB Target Requirements for SSCs are not mandated. If the SSC chooses to offer services for any of the non-core sub-functions, they must meet the applicable mandatory requirements at the time such services are provided to the customer. Customer agencies may seek non-core functions from an SSC, but are not mandated to do so.

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This approach allows agencies at their discretion to select services as needed to increase their focus on agency mission activities and the strategic management of human capital.

1.3 HR LOB Vision, Goals, and Objectives

The vision of the HR LOB is to provide “Governmentwide, modern, cost effective, standardized and interoperable Human Resource solutions providing common core functionality to support the strategic management of Human Capital and addressing duplicative and redundant HR systems and processes across the Federal government.”

To realize this vision, the HR LOB seeks to achieve the following goals and objectives:

GOALS	OBJECTIVES
Improved Management Improve the governmentwide strategic management of human capital	<ul style="list-style-type: none"> • Faster decision making • More informed policy making • More effective workforce management • Improved resource alignment with agency missions
Operational Efficiencies Achieve or increase operational efficiencies in the acquisition, development, implementation, and operation of human resources management systems	<ul style="list-style-type: none"> • Improved servicing ratio/response times • Reduced cycle times • Improved automated reporting
Cost Savings / Avoidance Achieve or increase cost savings/avoidance from HR solution activities	<ul style="list-style-type: none"> • Reduced duplicative software /hardware/operations/labor resources • Increased competitive environment
Improved Customer Service Improve customer service	<ul style="list-style-type: none"> • Increased accessibility to client and value • Improved communication and responsiveness • Enhanced quality • Enhanced timeliness • Enhanced accuracy • Enhanced consistency

Table 1 – HR LOB Goals and Objectives

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1.4 HR LOB Modernization Roadmap Methodology

The HR LOB segment architecture and Modernization Roadmap are based on the Federal Segment Architecture Methodology (FSAM) published by the Office of Management and Budget (OMB). The FSAM aims to achieve the following:

- Help architects identify and validate the business need and scope of the architecture
- Define the performance improvement opportunities within the segment
- Define the target business, data, services, and technology architecture layers required to achieve the performance improvement opportunities

The FSAM process steps conclude with the creation of a modernization blueprint document that includes a transition sequencing plan for using and implementing the segment architecture.

The HR LOB developed a draft Modernization Roadmap that drew from the FSAM to identify the current state of HRIT, document the target conceptual solution architecture, and provide a transition plan for reaching the target conceptual solution. This draft was released to HR LOB stakeholders for review and comment in January 2011. The HR LOB received and recorded 321 comments from 15 agencies over the course of the three-month review period. The HR LOB also met with stakeholders to discuss their comments and feedback. These stakeholders include business subject matter experts, technical subject matter experts, the HR LOB Multi-Agency Strategy Committee (MAESC) the HR LOB Customer Council (CC), the HR LOB Shared Services Advisory Council (SSAC), and OPM system owners. Their feedback was incorporated into this version of the report.

1.5 Document Structure

The four remaining sections provide an overall strategy and roadmap for modernizing HRIT. Section 2, Context for the HR LOB Modernization Roadmap, describes the overall context in which this Roadmap is being proposed including the HR LOB CONOPS and Enterprise Architecture, current service delivery and governance models, current technology, and the potential dollar benefits of achieving this vision. Section 3, Target Conceptual Solution Architecture, proposes a high level conceptual view of future HRIT, discusses how it will be delivered over time, and describes future governance. Section 4, Modernization Roadmap, provides a depiction of the overall steps that can be undertaken to realize this vision. And section 5, Funding Strategy, proposes activities that will leverage OMB's alternative funding approaches, as described in the U.S. CIO's 25 Point Implementation Plan to Reform Information Technology Management.

2 Context for the HR LOB Modernization Roadmap

There are a number of business drivers that provide important context for this Roadmap and compel its recommendations. The primary business driver is the goal of achieving the vision of the Human Resources Line of Business – governmentwide, modern, cost-effective, standardized, and interoperable HR solutions providing common, core functionality to support the strategic management of human capital. Other business drivers include:

- Capitalizing on existing innovation to supply new, innovative non-core solutions. Innovation already exists throughout the government; agencies are developing and deploying innovative HRIT to support non-core processes and practices. Existing innovative solutions can be scaled up for governmentwide use, providing agencies with a wider range of alternative solutions at relatively low cost.
- A move toward shared services and consolidation of IT in the Federal government. A key aim of the current administration is to reduce duplication, overlap, and fragmentation across the government. In its 25 Point Implementation Plan to Reform Federal Information Technology Management, OMB advocates for shared solutions through shared services, cloud services, commoditization of services, and data center consolidation.¹
- A fundamental shift in how the Government provides and consumes IT services. The current economic environment will not support a continually growing investment in a localized IT delivery model. Dramatic budget cuts are prompting agency officials to move away from localized resources and consider shared resources.
- The need to shore up and strengthen Federal shared services capability. The age of current Federal SSC technology and supporting environments must be addressed to mitigate the risk that these infrastructure issues pose to HR and Payroll capability across the Federal government. Agencies are interested in SSCs' non-core capabilities and SSCs must work with agencies to build this capability. Further, SSCs and OPM must focus on interoperability/integration and minimize the administrative burden on supervisors and employees by implementing simplified logon across Federal SSC and OPM solutions.
- Issues and challenges with the current implementation of Federal HR applications. IT supporting the HR function is currently implemented and managed in multiple organizations without an overall HRIT strategy or roadmap that lays out a common strategic direction and identifies resource sharing and integration opportunities. This Modernization Roadmap has been developed to begin to formulate this governmentwide guidance.
- Federal legislation, policy, and guidance. Over the years, Government mandates have been issued that provide a basis for this Roadmap. They include: the Information Technology

¹ U.S. Chief Information Officer. "25 Point Implementation Plan to Reform Federal Information Technology Information Management".

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Management Reform Act of 1996 (Clinger-Cohen); the E-Government Act of 2002, the Government Performance Results Act of 1993 (GPRA); and guidance from the Office of Management and Budget (OMB) including Circulars A-11, A-127, and A-130. OMB's budget passback guidance for Fiscal Year 2011 requires lines of business and agencies to develop and implement modernization roadmaps. It also requires agencies to document how they may use cloud computing platforms for major technology projects and to evaluate the adoption and use of the National Information Exchange Model as the basis for specifying cross-boundary information exchanges. (Appendix B provides a detailed list of these requirements.)

2.1 HR LOB Concept of Operations

A key governance document, the HR LOB Common Solution(s) White Paper and Concept of Operations (CONOPS), was published to define the HR LOB initiative when the initiative was launched in 2004. It discusses two dimensions that are fundamental to this line of business – common solutions and standardization.

The concept of common solutions is based on a model that according to the CONOPS “provides a business-driven approach to deliver solutions that are scaleable, modular, interoperable, and portable across a broad spectrum of users and uses”. The CONOPS also proposes that the common core functionality will be implemented by “utilizing shared service centers to support agencies and provide modern, cost-effective HR solutions and cross-functional capabilities while centralizing back office operations.” Standardization defines common and repeatable processes that make common solutions possible. These concepts became central to the HR LOB vision statement: “Governmentwide, modern, cost effective, standardized and interoperable Human Resource solutions providing common core functionality to support the strategic management of Human Capital and addressing duplicative and redundant HR systems and processes across the Federal government.”

More recently, the U.S. Chief Information Officer published a 25 Point Implementation Plan to Reform Federal Information Technology Management that has some striking similarities to the HR LOB CONOPS. That report's action plan provides directives for shared services, commoditization of basic software services, cloud computing, and data center consolidation. Advocating for shared services, it states, “Within the next 12 months, the Federal CIO will develop a strategy for shared services. That strategy will build on earlier Federal Government successes in shared services”² It will drive consolidation of services across the government to create substantial cost savings and allow agencies to optimize spending and to reinvest in their most critical mission needs.

The following diagram shows the HR LOB Concept of Operations and Service Delivery Model.

² U.S. Chief Information Officer. “25 Point Implementation Plan to Reform Federal Information Technology Information Management”.

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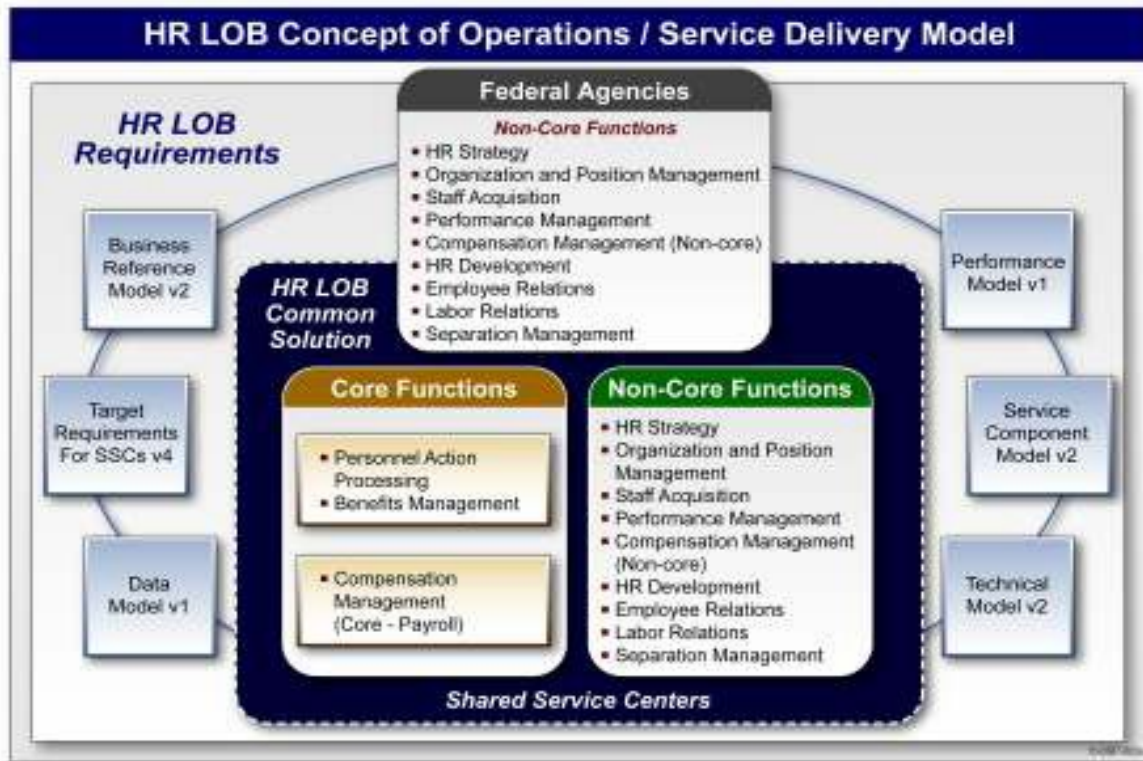


Figure 1 – HR LOB Concept of Operations / Service Delivery Model

The depiction shows that SSCs deliver services supporting personnel action processing, benefits management, and payroll. Federal agencies continue to be responsible for non-core functions but may use SSC services to support these functions. Requirements for these services are defined via the HR LOB Enterprise Architecture and the HR LOB Target Requirements for Shared Service Centers.

2.2 HR LOB Enterprise Architecture

The HR LOB Enterprise Architecture (EA) provides a single common view of the Federal human resources enterprise along with a vocabulary for discussing it. The HR LOB worked with over 200 Federal HR subject matter experts over a four-year period to construct the architecture. This investment was made to enable governmentwide dialog, debate, and collaboration around standardization, common solutions, and the shared services-based HR delivery model.

The Enterprise Architecture covers four different areas – business, information and data, services, and technical infrastructure:

- Business sub-functions, processes, and activities depicted and described in the HR LOB Business Reference Model
- Data and metadata described in HR LOB Data Model

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- Human resource services, human capital management services, and cross-cutting services described in the HR LOB Service Component Model
- Technical services and profiles described in the HR LOB Technical Model

The HR LOB EA provides a common language that helps HR LOB stakeholders:

- Identify, discuss, and assess opportunity areas
- Assess the IT impact of the identified opportunities
- Consider the right level of flexibility in the IT infrastructure and in the organization (e.g. procurement organization) to readily integrate services

The HR LOB Enterprise Architecture provides an important foundation for the conceptual solution architecture described in this Roadmap report by providing the conceptual building blocks that underlie it. The EA also provides a basis for the logical solution architectures that will be developed in the future – influencing alignment between future tactical, operational, and project decisions and activities with the HR LOB vision and objectives.

2.3 Implementation and Delivery of Current HRIT

HRIT in the Federal government is currently delivered via four different delivery channels: shared service centers, OPM, individual Federal agencies, and third party providers.

Shared Service Centers. The HR LOB established six Federal shared service centers (SSCs) and selected four private sector vendors to provide agencies with core HRIT services. The Federal SSCs are:

- Department of Agriculture's National Finance Center
- Department of Defense
- Department of Health and Human Services
- Department of Interior's National Business Center
- Department of Treasury
- General Services Administration

The private sector SSCs are:

- Accenture National Security Services
- Allied Technology Group, Inc.
- Carahsoft Technology Corporation
- International Business Machines Corp.

The Federal SSCs provide core HRIT services and some non-core HR applications to their agency customers. The private sector SSCs currently have no Federal customers for core services. More information about all of the SSCs offerings is available on OPM's website:

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http://www.opm.gov/egov/documents/MPG/service_delivery.asp

OPM. OPM provides governmentwide HR information technology in a number of areas including:

- Federal job information
- Hiring and staffing
- Personnel investigations
- Benefits and retirement
- Electronic official personnel folders
- HR data warehouse

Individual Federal agencies. Agencies play a very important role in the development and enhancement of HRIT products and services used throughout the Federal government. Agencies are major drivers of change and modernization in Federal HRIT through the efforts of their functional and technical experts working closely with the vendor/provider community.

Many non-core HR applications, applications supporting more strategic HCM processes, and agency-specific HR applications continue to be developed, implemented, and managed by each agency. For example, some agencies have developed or obtained modern HRIT solutions supporting:

- Classification
- On-boarding
- Workforce planning
- Competency management
- Performance and awards

Third party providers. Some applications that support non-core processes are implemented and managed by approved third party providers. They include:

- Position classification applications
- Hiring and staffing applications
- Learning management applications
- Performance management applications

2.4 Governance and Management of Current HRIT

In March 2004, OMB appointed OPM as managing partner to lead the Human Resources Line of Business (HR LOB). The HR LOB is advised by a Multi-Agency Executive Strategy Committee (MAESC) consisting of members from 24 agencies, including OPM. The MAESC is co-chaired by the OPM CIO and the OMB Portfolio Manager. The MAESC operates under a charter that was approved by the member agencies and signed by the OPM Director. The Requirements

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Board, which supports the HR LOB, oversees and approves the policy requirements for shared service centers (SSCs).

The following Web site provides additional details of HR LOB governance:

http://www.opm.gov/egov/HR_LOB/governance/index.asp

The MAESC is augmented by a number of advisory groups such as the Shared Service Center Advisory Council (SSCAC) and the Customer Council (CC). These groups meet on a regular basis to provide their point of view to the MAESC and to program personnel.

The Chief Information Officers (CIO) Council is outside the formal purview of the HR LOB governance structure but has definite influence and impact on creation and delivery of HRIT strategy across the Federal government. “The CIO Council was established by Executive Order 13011, Federal Information Technology, on July 16, 1996 and codified into law by Congress in the E-Government Act of 2002. The CIO Council serves as the principal interagency forum for improving practices in the design, modernization, use, sharing, and performance of Federal Government agency information resources. The Council's role includes developing recommendations for information technology management policies, procedures, and standards; identifying opportunities to share information resources; and assessing and addressing the needs of the Federal Government's IT workforce.”³

In August 2011, CIO authorities were expanded by an OMB memorandum that describes the “changing the role of Agency Chief Information Officers (CIOs) away from just policymaking and infrastructure maintenance, to encompass true portfolio management for all IT.” It advises agency CIOs to assume a lead role in commodity IT: “Agency CIOs must focus on eliminating duplication and rationalize their agency's IT investments... Agency commodity services are often duplicative and sub-scale and include services such as: IT infrastructure, enterprise IT systems, and business systems including finance, human resources, and other administrative functions. The CIOC charter will be amended to reflect these new responsibilities, which will allow more effective development and management of shared services, cross-agency initiatives, and governmentwide policy... Just as CIOs are tasked to find and eliminate duplicative systems in their agencies, the Council will seek opportunities to reduce duplication, improve collaboration and to eliminate waste across agency boundaries.”⁴

The Chief Human Capital Officers (CHCO) Council also influences HRIT strategy across the Federal government. The Chief Human Capital Officers Act of 2002, enacted in November 2002, required the heads of 24 Executive Departments and agencies to appoint or designate Chief Human Capital Officers (CHCOs). Each CHCO serves as his or her agency's chief policy advisor on all human resources management issues and is charged with selecting, developing, training, and managing a high-quality, productive workforce. The CHCO Act also established a Chief Human Capital Officers Council to advise and coordinate the activities of members'

³ www.cio.gov

⁴ OMB Memo M-11-29, Memorandum for Heads of Executive Departments and Agencies, August 8, 2011

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agencies on such matters as the modernization of human resources systems, improved quality of human resources information, and legislation affecting human resources operations and organizations.⁵

In addition to these centralized cross-government governance bodies, distributed HRIT governance structures exist throughout the Federal government. Shared service centers and agencies have governance structures that direct resources for their own operations and initiatives. OPM also has governance structures specific to each of OPM's governmentwide systems. These governance bodies may or may not work in conjunction with the MAESC or with one another. Having more coordination among governance structures could help to eliminate stove-piped HRIT efforts.

2.5 The Current Federal HRIT Landscape

The HR applications delivered by the various delivery channels today – SSCs, third parties, agencies, and OPM – all vary widely in terms of size, scope, complexity, and implementation technology. Some HR applications provide state-of-the-art HRIT functionality to their customer constituencies. Others are quite old and outdated requiring multiple work-around business processes to compensate for system and interface deficiencies. Some applications were built to accommodate multiple agencies' requirements. Many however are proprietary systems that were originally developed for the narrowly defined needs of a single agency component or specialized systems that support a specific and narrow set of business activities. While some system owners have begun efforts to integrate their systems and are employing standardized data exchange formats and processes, most of these applications were not created with integration in mind. They were developed when simple point-to-point interfacing was the only available means for data exchange, integration concepts were unproven, and there was no expectation that application systems should be interoperable. And while some agencies have consolidated HRIT, many agencies continue to operate their own HRIT.

OPM's suite of governmentwide systems in many ways reflects the larger HRIT context described above. As individual solutions, most OPM systems provide excellent services. However, integration and interoperability among OPM systems is lacking. The systems were developed by different OPM organizations to support various specific business services. For the most part, they were not developed with integration in mind; indeed, they were developed before integration concepts were mature enough to be seriously considered. However, some OPM organizations are beginning to consider how to interoperate their applications. USAJOBS, for example, has established a framework and standards that staffing systems vendors can use to interoperate with USAJOBS. OPM has established a Data Governance Board to deploy a metadata repository for OPM data that will standardize OPM data definitions and help rationalize the multiple data feeds to OPM. And OPM's Federal Investigative Services is developing an authentication solution that could at some point in the future be leveraged across OPM to support E-Authentication and single sign-on across multiple OPM systems. This is a

⁵ www.chcoc.gov

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positive trend and OPM system owners should continue to come together to ensure they have a single coherent approach to interoperating OPM governmentwide systems.

Figure 2 below depicts the current HR application landscape.

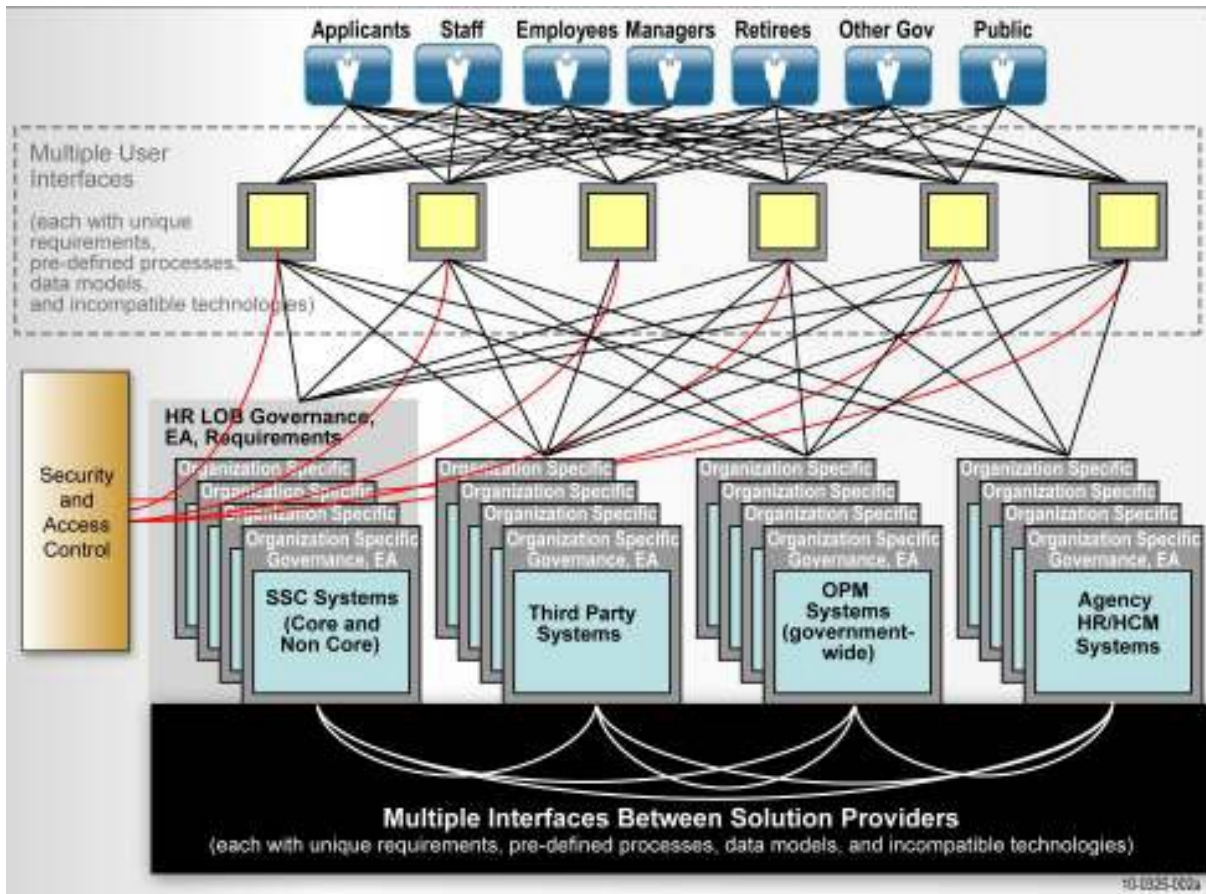


Figure 2 – Current HR Application Landscape

This Federal HR systems landscape has evolved over time without the benefit of a single overall business-driven strategy and architecture defining an IT environment in which HR information can be seamlessly shared across business processes and systems. Certain environmental conditions exist along with – and in some cases because of – this complicated Federal HRIT portfolio. These conditions produce challenges that stand in the way of interoperable HRIT:

- **Funding constraints.** Even when system owners understand the need for and benefits associated with governmentwide integration of HR applications, they are often bound by limited funding. This is a frustrating paradox for many enlightened executives, enterprise architects, and system managers: while the integration of systems could produce considerable cost savings, the funding needed to make it happen is not available. The U.S. CIO has stated, “The rapid pace of technological change does not match well with

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the Federal government's budget formulation and execution processes... Agencies need more (IT budget) flexibility to manage IT programs responsibly.”⁶ The reality is that modernization of systems which leads to interoperability and integration is a multi-year process that appears expensive in the short term and may never happen in the long term because of funding constraints and insufficient IT budget flexibility.

- Complex regulatory environment. Multiple laws and regulations for information security and protection have come into effect over the years. And while the need for integration is clear, the information sharing that the integration accomplishes can create information security issues.
- Diverse provider base. In general, the Federal government supports the notion that providing for choice among multiple vendors is more advantageous than relying on a single vendor for a given product or service. More choice may result in improved product quality. It also encourages open standards-based software over proprietary software. There are many “best-of-breed” packaged solutions offering various HR and/or HCM functionality with varying levels of automation. However, these applications are not necessarily built on the same set of standards or with integration in mind. Although the variety allows for choice, it also creates integration issues.
- Redundant application logic and duplicate data. There are numerous redundant HR systems across the government that were put into place to accommodate varying agency requirements. Duplicate data resides in multiple systems. In some cases, this data is moved from system to system via point-to-point interfaces; in other cases the data is manually entered multiple times. Having duplicate data produces a need for expensive data reconciliation processes. This reconciliation is time-consuming, expensive, and likely to strain the already limited resources of HR operational units.
- Lack of governmentwide technology standards for HRIT. Since HR applications were independently developed and were never expected to work in sync with other applications or exchange information meaningfully, there was never a need to develop and enforce technical standards and data standards that facilitate interoperability and integration.

These challenges limit the ability of the Federal government to remove the barriers between HR applications and make HR solutions truly interoperable. Unless these issues are addressed and resolved, the government will continue to see the effectiveness and efficiency of the HRIT function diminish while the total cost of operating and maintaining HRIT increases. The aggregate cost of HRIT is discussed in the following section.

⁶ U.S. Chief Information Officer. “25 Point Implementation Plan to Reform Federal Information Technology Information Management”.

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2.6 Potential Business Benefits

A key component of the shared services concept – and one of four goals of the HR LOB – is to achieve significant cost savings and/or cost avoidance related to HRIT. This can be achieved by standardizing business processes and consolidating supporting technology along with some business services to shared service centers. Significant cost savings may be achieved through the consequent reduction in duplicative software, hardware, operations, and labor resources.

In his 25 Point Implementation Plan to Reform Federal Information Technology Management, the U.S. CIO voices a concern about localized IT delivery models: “The Federal Government needs to fundamentally shift its mindset... Too often, agencies build large standalone systems from scratch, segmented from other systems. These systems often duplicate others already within the Federal Government, wasting taxpayer dollars.”⁷ Indeed, the numbers are quite staggering. The 2011 IT dashboard shows 2011 HRIT development, modernization, and enhancement (DM&E) spending to be \$650 million. Interestingly, HRIT DM&E spending for 2012 is projected to increase by 15% – to \$750 million.

In December 2009, the HR LOB produced a Cost Benefit Analysis (CBA), updating and expanding the original CBA that was published in 2004. The HR LOB used a comprehensive methodology to collect and analyze agency budget data to calculate the cost savings realized by agencies migrating core HR systems to shared service centers along with the cost avoidance of not developing and deploying new HR systems. Based on data collected, the current net present value of total cost savings and cost avoidance is over \$1.3 billion. Table 2 summarizes the results of the revised CBA. (A newly revised CBA will be published in the Fall of 2011.)

Revised CBA	
Overall Planning Costs	\$ (59,038,853)
Other Costs	\$ (377,429,568)
Overall Cost Savings	\$ 1,183,409,104
Overall Cost Avoided	\$ 626,290,891
Total Savings & Avoidance	\$ 1,373,231,574

Table 2 – HR LOB Cost Benefit Analysis

The following graph uses data from the 2009 CBA to compare average HRIT development, modernization, and enhancement (DM&E) spending per employee serviced. DM&E spend per employee serviced for those agencies that have not migrated to SSC HRIT averages slightly over \$133. DM&E spend per employee serviced at the SSC on the other hand is \$28. Agency DM&E spend per FTE is higher than SSC DM&E spend per FTE because SSCs serve a significantly larger number of employees; the per-employee cost is less because the population

⁷ U.S. Chief Information Officer. “25 Point Implementation Plan to Reform Federal Information Technology Information Management”.

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serviced is larger. If an agency were to migrate to shared applications for all of its HRIT needs, cost savings would be considerable.

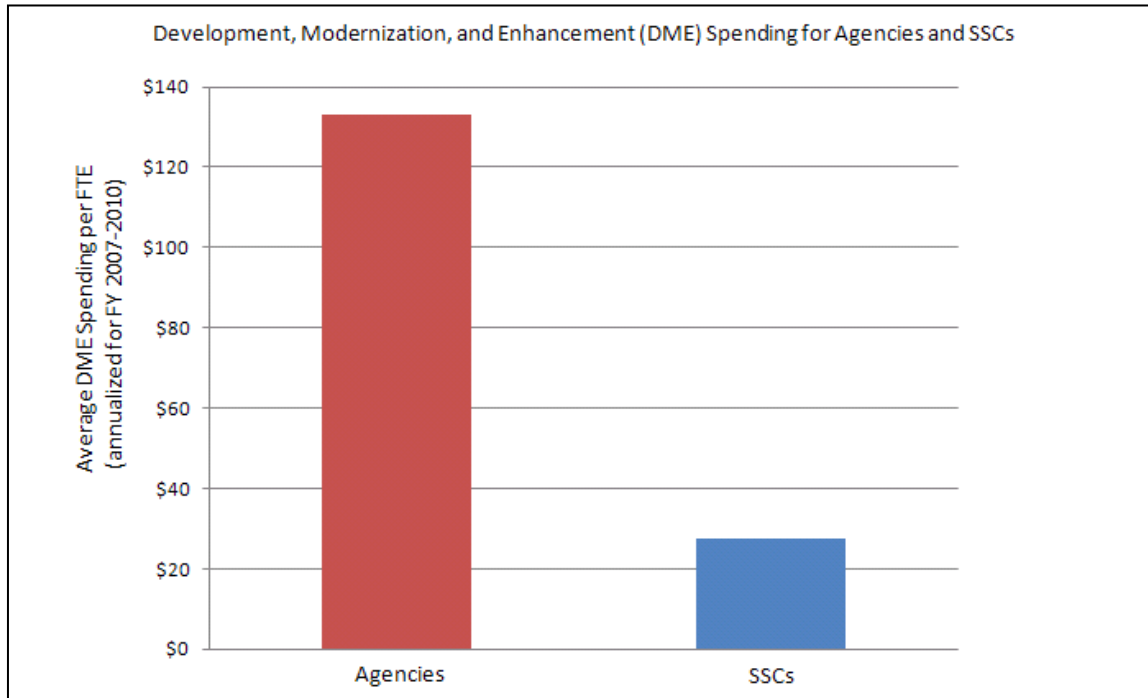


Figure 3 – DM&E Spend for Agencies versus SSCs

Cost savings is only one proposed benefit of the HR LOB vision of interoperable shared resources. Clearly, cost savings cannot completely supersede other benefits – operational efficiency, customer service, and improved ability to manage the HCM/HR function. Indeed, the 2009 CBA did report agencies’ anecdotal claims that moving to SSCs does improve operational efficiencies, improve customer service, and improve the management of the HCM/HR function. In this era of unprecedented Federal fiscal concern, in which agency core mission budgets are being significantly cut, agency executives must carefully scrutinize any investment of scarce dollars on duplicative HRIT systems and back-office functions.

3 Target Conceptual Solution Architecture

This section describes the future state – the Target Conceptual Solution Architecture – in which multiple HR application suites function in an interoperable/integrated environment. The HR LOB target conceptual solution architecture is a service component based approach that facilitates “plug-and-play” and “mix-and-match” solutions using a Service Oriented Integration (SOI) paradigm. In concept, service components are service provider neutral, allowing for the selection of any combination of service components from any provider to meet the agency HR mission needs. Open standards make possible these adaptive, dynamic, and responsive HR services.

3.1 Building Blocks of the Target Conceptual Solution Architecture

Currently, HRIT implementations use multiple vendor applications. They support multiple user interfaces and they have different methods of storing data. Some of these applications use a Web-based interface, whereas some use application level interfaces. Supporting these different interfaces is a serious challenge for SSCs and agencies.

The HR LOB target conceptual solution architecture described in this section defines an integrated solution for the future where these multiple applications function in an interoperable/integrated environment and deliver productivity improvements, increase reuse, and share information across implementations. The following diagram shows a high level (conceptual level) service oriented integration view of the target solution. Consistent with the above definition of SOI, the integration that is achieved in this target solution is achieved using only service interactions – accomplished by a facility known as the Interoperability and Integration (I&I) facilitation solution. It should be noted that while this conceptual view shows only one instance of the I&I solution, it is likely that more than one instance will be implemented. However, the number of implemented instances must be controlled and all instances should be in compliance with a single set of governmentwide standards. Additionally, some Federal agencies are already pioneering these concepts. Implementation of the target architecture should leverage to the extent possible existing technologies, practices, and expertise.

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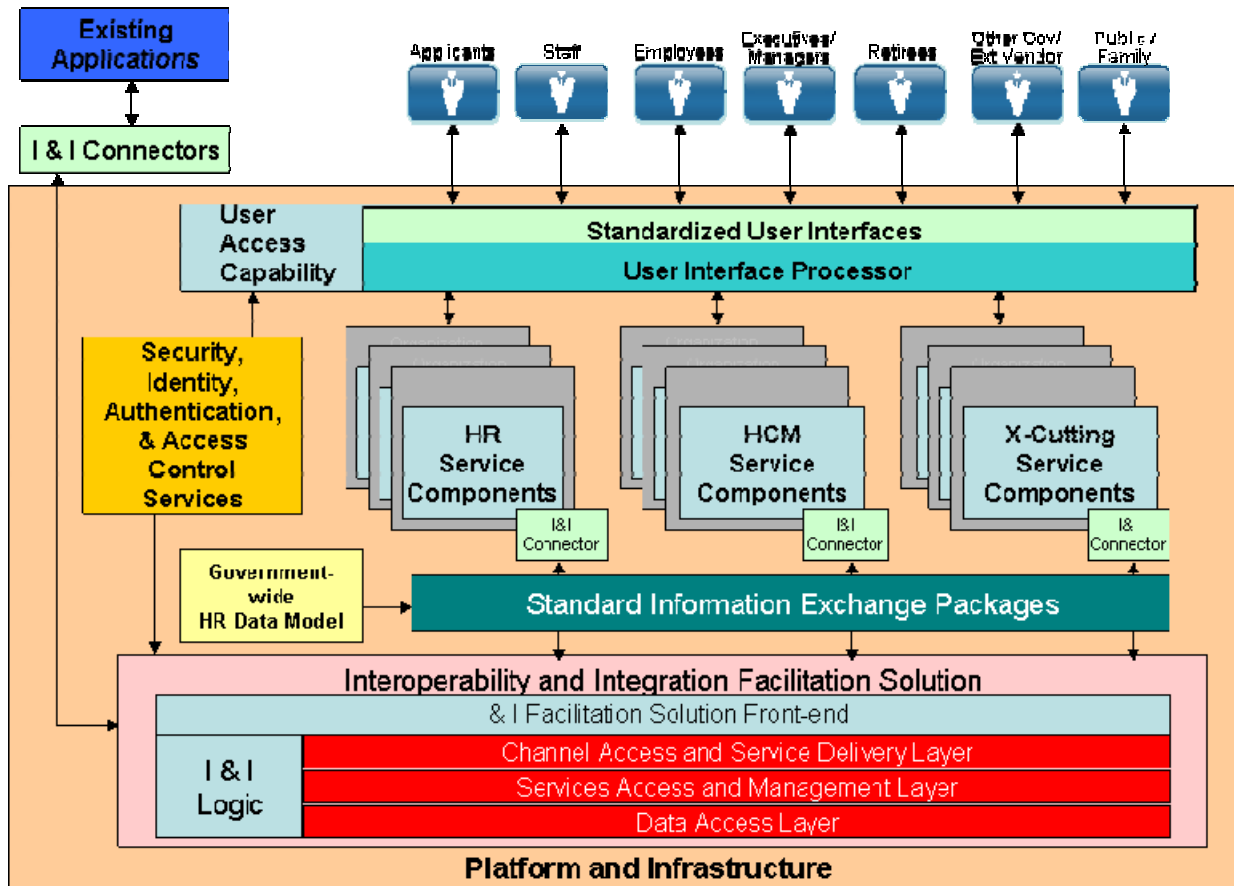


Figure 4 – Target Conceptual Solution Architecture

In this solution context, services and service components communicate based upon the desired objectives and results, regardless of implementation technology. The I&I facilitation solution routes this communication via the appropriate transport to the target service. Because service-centric solution is transport-agnostic, it can reuse existing enterprise messaging infrastructure for communication if necessary. This protects existing investments and eliminates the need for duplication of infrastructure.

There are four major components of this conceptual solution architecture:

1. User access capability
2. Interoperability and integration connectors
3. Standard information exchange packages
4. Interoperability and integration facilitation solution

All these components will be implemented on platform and infrastructure. Platform includes operating systems, database management systems, directories, security services, and workflow middleware. Infrastructure includes servers, networks, communication links, and data storage. Although these platform and infrastructure resources are critical to this conceptual architecture,

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they are not described in detail in this section. More information about platform and infrastructure resources can be found in the HR LOB Technical Model (one of five artifacts of the HR LOB Enterprise Architecture).

User Access Capability

User access capability has two components, standardized user interfaces and the user interface processor. This capability provides standardized and uniform access channels and delivery channels that satisfy business requirements (e.g., legislative compliance). Although the user access capability will be defined and managed at the agency level, it will be consistent and compliant with the single governmentwide set of standards that have been set for user access capability.

Portals are commonly used for user access capability in the Web environment. There can be many types of portals such as information portals, collaboration portals, and expertise and knowledge portals. A portal provides a base set of functionality such as role-based security, a unified view of information, a standards-based platform, and scalable architecture.

Standardized user interfaces. The main focus of standardized user interfaces is providing intuitive, user-friendly, ergonomic, and functionally organized presentations or portals that guide user interactions. Standardized user interfaces will be clear, concise, responsive, consistent, efficient, and forgiving. Standardized user interfaces are established to accommodate a broad spectrum of users with a range of expertise and needs – from novice users to power users to administrators.

All user interface (UI) elements and relevant information in an application shall be available to and usable by users with disabilities, including users who employ assistive technologies. The standardized user interfaces are mainly based on Web Content Accessibility (WCA) standards such as W3C Standards (Document Object Model (DOM), HTML, HTTP, CSS, XML, and URI/URL); ISO Web Usability Standards ISO/AWI 23973; and Section 508 guidelines. The HR LOB TM defines the user portal standards profile view. This profile view defines presentation/interface standards, Web browser standards, and desktop standards.

User interface processor. The major role of the user interface processor is to handle the initial routing of incoming user events. It also dispatches to the appropriate target objects action messages forwarded to it by control objects. In addition, the user interface processor maintains a list of all the windows currently open in the application.

The user interface processor performs following functions:

- Navigation and workflow control – managing the flow of information through the user interface components
- Managing the transitions between stages of a user tasks and modifying user process flow in response to exceptions

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- State management – passing state and maintaining consistency of state between views for Windows-based applications and Web applications
- Maintaining internal business-related state, usually by holding on to one or more business entities that are affected by the user interaction
- Data presentation management and display formatting
- Parameterization and editing

The user interface processor also contains navigation methods that are called by the standard user interfaces that determine the views that will be shown to the user; functional methods that are called by the standard user interfaces; and state methods that store information in the persistent storage device.

Interoperability and Integration Connectors

Interoperability and integration (I&I) connectors are a set of solutions consisting of technology, services, and software that are developed as extensions to existing application systems. Each I&I connector enables the sharing of resources and handles the communication between its application system and the I&I facilitation solution. These plug-ins provide for “loose coupling” between the applications and the integration capability.

Many commercial off-the-shelf (COTS) packages have this type of facility that can be configured to the needs of the environment into which it is being implemented. The HR LOB Technical Model defines an interoperability standards profile that can be used for designing and developing an I&I connector module for legacy applications. Web services, Java beans, Java business integration, and Enterprise Service Bus (ESB) are examples of the technologies that can be used to develop the I&I connector. The connector module can be a portal, application programming interface (API), message-oriented middleware (MOM), or transaction-based middleware – depending upon the type of application system and interoperability needs.

Standard Information Exchange Packages (IEPs)

The National Information Exchange Model (NIEM, see Appendix A) defines IEP as:

- An eXtensible Markup Language (XML) schema representing a set of data that is transmitted for a specific business purpose
- The actual XML instance that delivers the payload or information

The standard information exchange packages in this depiction are developed from the governmentwide HR data model and represent the data that will be exchanged between pairs of service components. They consist of both XML schema specifying the data to be transmitted and the actual XML instances that move the data to and from the various applications. This data movement is accomplished by the I&I facilitation solution interacting with the application’s integration-enabling capability – its I&I connector.

Interoperability and Integration Facilitation Solution

The interoperability/integration among Federal HR application systems will be achieved using an interoperability and integration (I&I) facilitation solution (for example, an extended functionality enterprise service bus). The I&I facilitation solution will allow application systems to be interoperable/integrated by facilitating seamless data sharing and minimizing the redundant data and application logic.

The interoperability and integration facilitation solution consists of five components: I&I front-end module, I&I logic module, and three access layers: channel access and service delivery layer, services access and management layer, and data access layer. These layers will provide the coupling between various architectural model components of the solution.

I&I front end. The I&I front end contains the logic and services that will enable connection of the I&I facilitation solution to the I&I connector module of the application system.

I&I logic module. The I&I logic module contains the services that perform routine integration activities. These services are stateless and context-free, so they can be called in any sequence and be reused. These integration services are dynamically configurable (at the run-time) and use declarative programming techniques. This module also contains business rules for interoperability and integration. Quality of Service (QOS) requirements may also be implemented as services in the I&I facilitation system.

Channel access and service delivery layer. The channel access and service delivery layer provides portal/user interface and an application programming interface (API) capability and services. The portal interface serves as the single window login interface for the system and uses LDAP (Local Directory Access Protocol) protocol to validate the users. Once the users are authorized, they are given access to all the services available in the system for which they have been authorized. The portal interface provides the users the ability to invoke the available services and select the operations that are built over these services, which can also be invoked directly by an API.

Service access and management layer. The service access and management layer is the backbone of the service oriented integration. It consists of four sub-layers:

1. Mediation and transformation layer
2. Routing and distribution layer
3. Mapping, correlation, and enrichment layer
4. Orchestration layer

The mediation and transformation sub-layer consists of services that remove the application specific characteristics from the messages before passing them to the next layer which executes the integration choreography. This is a style which is particularly suitable in those instances where integration services will be called from different requesting applications over different

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transports and with different data formats. An application specific mediation service processes messages from each application but the central integration service is provided once and accessed via multiple mediation services.

The routing and distribution sub-layer provides functionality for sending messages to the proper receiver. Routing services select service providers based on content and context. Distribution services distribute the message to a set of interested parties.

The mapping, correlation, and enrichment sub-layer consists of services that act on the content of the message by providing additional information that facilitates interoperability/integration.

And the service orchestration sub-layer provides services that track, monitor, and propagate service access events.

Data access layer. The data access layer is the central component in mediating and coordinating a data access request. This layer provides data discovery services, data mapping and transformation services, data reformatting services, schema matching, and integrity checking services. In addition, the data access layer provides a generic interface for database operations and services to access/update the data stores. The data access layer will support service data objects (SDO) that facilitate a single and uniform way to access and manipulate data from heterogeneous data sources including relational databases, eXtensible Markup Language (XML) data sources, Web services, and enterprise information systems (EIS). In an ideal service oriented integrated environment, the data access layer can also provide following data services:

- Automated query planning and processing from high-level queries
- Distributed query execution
- Data integration result consolidation
- Data transport methods and protocols
- Integrity checking of integrated data
- Data source security

Security, identity, authentication, and access control services define components that support the protection of an organization's hardware/software and PII assets as described below:

- Identification and authentication defines the service component that provides capabilities that support obtaining information about those parties attempting to log on to a system or application, for security purposes, and the validation of those users
- Access control defines the service component that provides capabilities that support the management of permissions for logging onto a computer or network
- Intrusion detection defines the service component that provides capabilities that support the detection of illegal entrance into a computer system
- User management defines the service component that provides capabilities that support the administration of computer, application and network accounts

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- Role/privilege management defines the service component that provides capabilities that support the granting of abilities to users or groups of users of a computer, application or network

These services are based upon FICAM guidelines and HR LOB Identity and Authentication Reference Model and are appropriately embedded in the conceptual solution architecture components. Information about FICAM guidance can be found in Appendix A.

3.2 Implementation and Delivery of the Target Solution

This section proposes a future delivery model for the target solution, describing the manner in which the target solution will be delivered to the consumers of the services. Generally speaking, the operational success of Federal HRIT will depend upon optimizing business operations by enabling them with information technology. This will be accomplished in part via a service oriented culture – where business needs are met through delivering a defined collection of IT-enabled services. More information about services concepts can be found in Appendix A.

The target solution proposes just this sort of service orientation. The goal is to create and deploy multiple services delivered by multiple providers who coordinate, re-assemble, and reuse assets to provide the best value for the Federal enterprise. This approach will thus promote the integrated, interoperable “plug and play” capability that is described in the HR LOB CONOPS.

The HR LOB Service Component Model, one of the five formal HR LOB Enterprise Architecture artifacts, identifies and defines these business services. It defines 33 HR / HCM service components: eight service components support core HR processes, nine service components support non-core HR processes, and sixteen service components support HCM processes. The HR LOB SCM is on the HR LOB website at:

<http://www.opm.gov/egov/documents/architecture/HRLOBSCMv2.pdf>

These services are listed below.

Core Human Resources Service Components:

- Benefits Processing
- Benefits Reporting
- Employee Self-service
- Manager Self-service
- Payroll Processing
- Payroll Reporting
- Personnel Action Processing
- Time and Attendance

Non-core Human Resources Service Components:

- Application Management

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- Benefits Counseling
- Health and Fitness
- Learning Administration
- Pay Administration
- Position Classification
- Recruiting
- Unemployment Compensation
- Workers Compensation

Human Capital Management Service Components:

- Competency Management
- Succession Planning
- Workforce Planning
- Workforce Reshaping
- Organization Design
- Position Management
- Assessment Model
- Staffing
- Career Development Planning
- HRD Needs Assessment
- HRD Program Development
- Education / Training Delivery
- Human Capital Program Review and Assessment
- Performance Management
- Employee Relations
- Labor Relations

Additionally, there are 30 “cross-cutting” service components – services that are outside the HR / HCM domain but directly support HR and / or HCM processes. They are listed below, organized by service type.

- Data Management
 - Data Exchange
- Financial Management
 - Labor Cost Allocation
- Customer Relationship Management
 - Customer Support
 - Call Center Management
 - Customer Feedback
 - Partner Relationship Management
 - Marketing
- Customer Initiated Assistance
 - Employee Assistance Program
- Business Intelligence

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- Decision Support and Planning
- Reporting
- Data Mining
- Strategic Planning and Management
- Activity-Based Management
- Presentation
 - Multimedia
- Analysis and Statistics
 - Modeling and Simulation
 - Predictive Analysis
 - Mathematical Methods
- Information Services
 - Knowledge Management
 - Content Management
 - Records Management
- Management of Process
 - Project Management
 - Consultative Services
 - Program Management
 - Requirements Management
 - Quality Management
 - Risk Management
 - Change Management
 - Configuration Management
- Tracking and Workflow
 - Process Tracking
 - Case / Issue Management

The plug and play aspect of the target solution architecture requires the ability to “thread” multiple service components together to satisfy customer needs. The envisioned architecture is based on open standards that facilitate an adaptive, dynamic, and responsive HR enterprise. It provides for service provider neutrality – allowing the selection of any combination of providers’ service components needed to meet customer agency needs.

Because of the size and complexity of the US Federal government and the breadth of services required to support the HR/HCM business function no single service delivery method can be expected to satisfy customers’ needs; multiple methods will be used over the course of the planning horizon of this Roadmap. The proposed end state will thus be a blended delivery model where multiple modes of delivery coexist with multiple provider roles to form a “coexistent” model of implementation and delivery. The following diagram depicts this coexistent model.

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	Localized – for agency's own use or available to a single customer	Shared – used or shared by multiple agencies or available to multiple customers	Virtual – commoditized and available to multiple customers in the cloud computing environment
service solution provider	Service solution providers offer non-standardized HR, HCM, and/or cross-cutting solutions that are unique to each customer's requirements	Service solution providers offer a portfolio of common HR, HCM, and/or cross-cutting services	An HR, HCM, and cross-cutting services portfolio is provisioned by the service solution provider in a cloud computing environment
application provider	Applications are owned by everyone – providers and individual Federal agencies	HR, HCM and/or cross-cutting applications are made available by the application provider for inclusion in the service solution provider's portfolio	HR/HCM and cross-cutting applications are made available by the application provider to the service solution provider who provisions them in the cloud
platform provider	Platform resources are owned and operated by everyone – providers and individual Federal agencies	Platform resources are owned by the platform provider and made available (resold to) infrastructure providers and/or service solution providers	Platform resources are provisioned by the platform provider from the cloud for use by infrastructure providers and/or service solution providers
infrastructure provider	Infrastructure resources are owned and operated by everyone – providers and individual Federal agencies	Infrastructure resources are owned by a provider and are made available for use by other providers	Infrastructure resources are consolidated to a virtual cloud environment and provisioned by the infrastructure provider

Figure 5 – The Coexistent Model of Service Delivery

In the proposed delivery framework, there are four provider roles that deliver these services and the technology that enables these services. These provider roles are described below.

The infrastructure provider is a supplier of highly scalable computing resources including mainframes, servers, storage devices, and networks. Federal agencies that offer data center computing resources to other agencies – such as the General Services Administration and Department of the Interior's National Business Center – are infrastructure providers. Federally-approved private sector companies that offer data center computing resources to Federal agencies – such as Google, Microsoft – may also perform this infrastructure provider role.

The platform provider is a supplier of IT resources that make applications operable on a given infrastructure. Examples of these IT resources include database management systems, authentication/authorization/ single sign-on capabilities, workflow automation services, virtualization software, application development accelerators, testing and QA tools, scheduling services, security services, and directory services. One example of a Federal agency that offers platform services to other agencies is the General Services Administration (E-Authentication Initiative). And in the future, private sector companies (e.g., Amazon [computing instances], Oracle [database management resources], Cisco [network management resources]) may be approved to offer these platform resources to Federal agencies.

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The application provider is a supplier of application software that support or enable HR and HCM processes. Vendors of large-scale ERP software (e.g., Oracle [E-Business Suite, PeopleSoft Enterprise applications], Kronos [webTA] are application providers. HR LOB Shared Service Centers also build and operate application software and are thus also application providers. OPM is an application provider by virtue of the fact that it offers governmentwide application software services (e.g., USAJOBS, USA Staffing, EHRI, e-QIP, etc.) to Federal agencies. And some Federal agencies are doing a very good job of providing HR applications to their agency customers.

The service solution provider is a supplier of interoperable services. The service solution provider serves as the “integrator” – the consolidation point for all services and applications. The service solution provider assembles capability as needed – infrastructure, platform, applications, back office services – to create a portfolio of services that have value to the Federal customer agency. The HR LOB-approved Federal and private sector Shared Service Centers are all HR LOB service solution providers.

Each of these provider roles can deliver their services via three possible delivery modes: localized, shared, and virtual.

In the localized delivery mode, resources are organization-specific – owned and operated by an agency for its own use or made available by a provider for use by a single customer. Applications, platform resources, and infrastructure resources are owned by everyone – service providers and individual Federal agencies.

In the shared delivery mode, resources are used by multiple entities. Providers make resources available to multiple customers and providers partner with other providers to jointly offer services – through joint operations, reseller arrangements, joint licensing agreements, etc. At the application level, application providers and vendors continue to own HR/HCM and cross-cutting applications but the applications are also made available to other providers for resale to their customers. At the platform level, platform resources continue to be owned by a provider and are made available (resold to) infrastructure providers and/or service solution providers. And at the infrastructure level, infrastructure resources are also owned by a provider and are made available for use by other providers. The shared mode encourages partnering among providers and sharing of hardware, software, and middleware resources wherever possible.

In the virtual mode, resources are commoditized and made available in the cloud computing environment. HR/HCM and cross-cutting applications are provisioned in the cloud by the application provider for resale by the service solution provider. Platform resources are provisioned by the platform provider from the cloud for use by (resale to) infrastructure providers and/or service solution providers. And infrastructure resources are consolidated to a virtual environment “cloud” environment and provisioned by the infrastructure provider. More information about Cloud computing can be found in Appendix A.

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A limited version of the coexistent model of service delivery is in practice today, where some services are being shared and some providers are considering virtual systems. However, many IT resources continue to be localized. Federal agencies own and operate their own HR applications and supporting platform resources and infrastructures. And some providers operate localized HR applications – accommodating their multiple customers’ disparate business processes and/or maintaining separate instances of their applications for their customers.

The overall objective proposed by this Roadmap is that providers work with customer agencies to shift implementation and delivery from left to right on this framework – from localized resources to shared and/or virtual resources. The Roadmap does not propose a wholesale shift from localized to virtual. Some technology should remain at the localized level because it must support agency-specific needs and standardizing to shared services is not a viable option. Similarly, it may not be practical or technically feasible to virtualize or commoditize some services. Sample criteria for determining “cloud-appropriateness” include:

1. Business process is ready; it is stable and can adapt with minimum changes to a cloud delivery infrastructure
2. Application is ready; it is already web-based and scaleable
3. Transaction data volumes are not very high
4. Web is the desired service delivery platform
5. Data ownership, stewardship, security, and access rules are clearly defined
6. Points of integration are well defined; applications running in the cloud will require integration with applications running on-premise and other applications in the cloud; a robust I& I facility is a prerequisite for the cloud computing environment
7. Application does not require specialized interfaces
8. Regulatory compliance; cloud computing services for data and applications must closely adhere to compliance regulations and demonstrate a high degree of transparency
9. Potential for reducing overall costs; overall costs can be decreased by moving the service to the cloud (migration and overhead costs vary widely based on the target cloud platform and will thus skew the estimated cost savings)

Based upon the above criteria, some HR/HCM service components are better candidates for virtualization than others. A thorough analysis must be done for all HRIT applications to determine their suitability for virtualization and cloud readiness.

It should be noted that virtualization is already happening in the infrastructure areas such as local area networks (LAN), virtual private networks (VPN), servers, and desktops. Virtualizing software and applications is relatively more complex and difficult; not all HRIT software and applications are suitable for virtualization. Migrating legacy applications based on old programming languages and technologies to a cloud-based infrastructure will not bring the benefits that would justify the investment required to move to the cloud. A more traditional managed hosting solution would be a more desirable alternative. Therefore, key HRIT applications must be evaluated for suitability of virtualization and for cloud-readiness. Applications running in the cloud will require integration with applications running on-premise and other applications in the cloud. A robust integration platform needs to be available to

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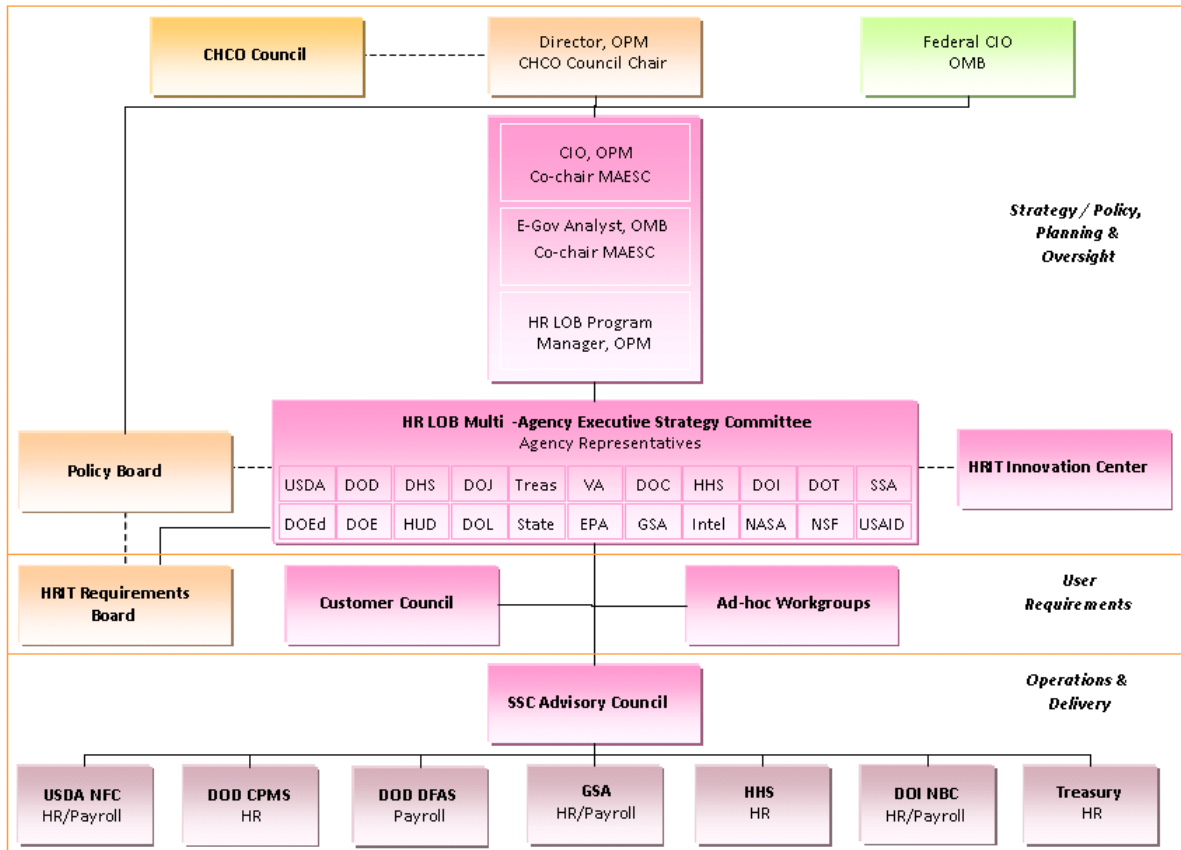
facilitate this. Other factors that influence application virtualization and migration to the cloud environment include data ownership, security, regulatory compliance, and cost.

3.3 Governance and Management of the Target Solution

Governance ensures that roles, processes, and guidance are in place to set clear expectations, provide leadership toward meeting expectations, and verify expectations are being met. Good governance is participatory, transparent and accountable. When the HR LOB program was launched in 2004, a multi-tiered governance approach was put into place which has successfully encouraged participation across its multi-agency community of stakeholders, promoted transparency and openness, and ensured accountability for delivering results that meet expectations. The HR LOB will capitalize on the success of its governance and continue to leverage its governance structures and processes for the design, development, and deployment of the target solution and the shift to shared and virtual delivery models.

Governance Structure

The HR LOB governance structure has three tiers, 1. Strategy/Policy, Planning and Oversight; 2. User Requirements; and 3. Operations and Delivery. It is depicted in future 4 below.



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Figure 6 – HR LOB Governance Structure

- **Strategy/Policy, Planning and Oversight.** The Multi-Agency Executive Strategy Committee (MAESC) is the permanent chartered governance body of 24 participating agencies that serves as the primary decision body that sets direction for the HR LOB. It meets regularly to take decisions on planning and strategy formulation, performance management, SSC support and management, HRIT transformation, and provider oversight. The Chief Information Officer at OPM and the E-Gov analyst at OMB share the MAESC co- chair role.

The MAESC’s role in HRIT modernization is to formally approve the target solution and delivery vision, work with the Innovation Center to identify and support initiatives to accomplish modernization, address resource and funding issues, and monitor modernization progress.

- **User Requirements.** The user requirements tier of the governance structure is comprised of workgroups and sub-committees that come together to develop work products that appropriately reflect stakeholder perspectives and needs. This tier leverages the considerable agency subject matter expertise in HR functions and the HRIT that supports these functions. It also encourages communication among stakeholder groups and includes the HR LOB Customer Council – providing the “voice of the customer”.

The role of the user requirements tier in HRIT modernization is to provide subject matter expertise to help ensure the target solution and delivery models meet customer needs. It will also help ensure customer agencies are moving in the direction proposed by the Roadmap.

- **Operations and Delivery.** This tier of the HR LOB governance provides the “voice of the provider” and is comprised of operationally-focused members of the Federal HR SSC community. Its formal governance body, the Shared Service Center Advisory Council (SSCAC), meets on a regular basis to discuss the operational challenges of delivering the HR and payroll services and other issues related to meeting the target requirements established by the HR LOB.

The role of this tier in HRIT modernization is to provide subject matter expertise and a provider point of view to help ensure the target solution and delivery models are credible and achievable from a provider standpoint. It will also help ensure providers are moving in the direction proposed by the Roadmap.

HRIT Innovation Center

A new entity will be inserted into this governance structure – the HRIT Innovation Center – to make recommendations to the MAESC on how innovation can be applied to HRIT solutions and solution delivery. The center will bring together people with a variety of backgrounds, viewpoints, and skills to offer fresh new ideas. It will report to the MAESC and be comprised of

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technology subject matter experts from across the government (HRIT experts, agency HR SMEs, SSC staff, and OPM policy experts) who will:

- Promote and monitor HRIT modernization and integration efforts in agencies across the Federal government.
- Promote sharing and virtualization of services; help identify opportunities for partnerships.
- Serve as an information clearinghouse for information about shared and virtual resources and about OMB-sanctioned flexible budget approaches.
- Be a technology incubator, supporting the identification, development, and deployment of innovative solutions and solution delivery; provide a technology sandbox, allowing for the creation and iteration of technology prototypes.
- Build an innovation community to facilitate the cross-pollination of good ideas and provide a clearinghouse for agencies to share ideas and innovations that could have cross-agency applicability and impact.
- Identify innovative HR applications that agencies are currently offering to their user base and/or identify particularly effective methods of delivering services or applications; demonstrate the solution and/or delivery approach in a wider context.
- Establish and promote innovative points of view by performing ongoing research, publishing white papers, and sharing analysis results.
- Promote and share best practices for technology sustainment strategies
- Be the hub for governmentwide HRIT standards development; work with the HRIT Requirements Board and leverage the subject matter expertise that exists in the government – particularly at Federal agencies – to develop governmentwide requirements for certain capabilities.
- Manage the certification of all HR LOB applications provided for Federal use by COTS vendors to support core and non-core functions.
- Spearhead the deployment of the cross-government interoperability and integration facilitation solution.

Processes, Standards, and Guidance

An interoperable HRIT environment requires that the interoperable components are built using identical – or at least compatible – standards. An interoperable target solution will require certain common processes and standards to be put into place to facilitate interoperability. Shared and virtual delivery models will also require common processes and standards that govern the delivery of services to multiple customers across multiple environments.

One of strengths of the proposed conceptual solution architecture is the flexibility that results from having multiple service providers. To create this increased flexibility, the solution brings together and orchestrates many services. Processes and standards help to minimize complications that potentially result from extraction and integration of services into a comprehensive service delivery approach. They also help set the clear terminology and communication convention, where the solution components cross traditional enterprise

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boundaries and operational contexts, and where increased connection among business processes, functional capabilities, organizational entities, end users, applications, and data is desired.

Standards fall into four overall categories: data standards, interoperability standards, cloud standards, and architectural standards.

- **Data Standards.** The HR LOB will lead the development of a governmentwide HR data model. This will be the foundational standard for government-wide HR data – compliant with NIEM and XML standards. NIEM has been adopted as government standard for data exchange. The HR-XML Consortium is the only independent, non-profit, volunteer-led organization dedicated to the development and promotion of a standard suite of XML specifications to enable e-business and the automation of human resources-related data exchanges. HR-XML standards are principally concerned with defining messages communicated between and among software components.
- **Interoperability Standards.** The HR LOB Technical Model Version 2, Section 3 describes interoperability as applicable to HR LOB. This section describes interoperability dimensions in relationship with HR LOB EA models. Application, data, and infrastructure interoperability standards are also defined in this section.
- **Cloud Standards.** Cloud computing is currently in its early formative stages and is currently operationalized by an amalgamation of proprietary products and approaches. Standards are largely de facto, though progress has been made in some areas. NIST created the Standards Acceleration to Jumpstart Adoption of Cloud Computing projects. NIST publication SP 800 – 25 defines cloud computing terminology. Standards organization IEEE has decided to get involved in cloud computing, starting with two development projects related to cloud interoperability. The Cloud Security Alliance was formed to promote a series of best practices to provide security assurance in cloud computing. The DMTF focuses on IaaS (Infrastructure as a Service) and providing standards that enable IaaS to be a flexible, scalable, high-performance infrastructure. The OCC goal is to support the development of standards for cloud computing and frameworks for interoperating between clouds. The Open Cloud Consortium has a number of different working groups devoted to varying aspects of cloud computing.
- **HR LOB Enterprise Architecture.** The HR LOB has created an Enterprise Architecture (EA) in line with the Federal Enterprise Architecture (FEA) to assist Shared Service Centers (SSCs) and their customer agencies standardize their HR processes and technology. Each of the HR LOB EA artifacts has been created as part of a multi-agency effort. The architecture provide an overall business blueprint for the Human Resources business function and thus should be considered as a set of architectural standards for the target solution.

In addition to the above, OMB has published definitive guidance that will have a direct impact on HRIT modernization – the adoption of cloud computing and the use of the National Information Exchange Model.

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- **OMB Cloud Computing Guidance.** Effective immediately, agencies are required to institute a 'cloud first' implementation approach for all IT investments. If a secure, reliable and cost-effective cloud solution exists, agencies are required to implement that solution. All agency cloud evaluations must include an assessment of cloud solutions approved by the Federal Risk and Authorization Management Program (FedRAMP) and leverage enterprise cloud computing procurements such as IaaS. This language supersedes the FY 2011 Passback language for cloud computing.

- **OMB Guidance on the National Information Exchange Model.** The following is the excerpt from Office of Management and Budget's (OMB) Passback to Agencies that requires each of them to evaluate use of the National Information Exchange Model (NIEM) for their cross-boundary information exchanges: "By 5/1/2010, all agencies shall evaluate the adoption and use of the National Information Exchange Model as the basis for developing reference information exchange package descriptions to support specification and implementation of reusable cross-boundary information exchanges. A cross-boundary information exchange is one that crosses a bureau or agency boundary, including information sharing with international, State, local, tribal, industry, or non-governmental organization partners. The evaluation should include an alternatives analysis, cost-benefit analysis, and gaps or issues, if any, in governance and cost sharing based on provided template."

Governance helps minimize complications that may result from the integration of these services into a comprehensive service delivery approach. Governance helps set the clear terminology and standards of communication where solution components cross traditional enterprise boundaries and operational contexts. Governance increases the potential for connection among business processes, functional capabilities, organizational entities, end users, applications, and data.

The delivery of shared and virtual services requires that the many providers work together to integrate or consolidate business processes, application functions, and data to provide interoperable solutions to various sets of customers in a seamless manner. Governance is key to making this happen.

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4.1 Transition Patterns

In a coexistent model of service delivery, heterogeneous HRIT – localized resources, shared resources, and virtual services – exists throughout the government. The heterogeneity of the technology, coupled with the number of HRIT owners and operational environments, suggests that transition to a shared or virtual services environment will not be via a single transition approach, a single transition event, or a single coordinated transition plan. Delivery of services will evolve as service delivery shifts from localized to shared and virtual.

This transition will be an ongoing process for the foreseeable future as partnerships for sharing resources are built and the virtual services delivery environment and virtual computing capabilities become mature enough to be adopted on a widespread basis. The benefit of this incremental approach is that it encourages deliberately paced movement to shared and virtual resources in a manner that maximizes the value to the organization without interrupting the business. A macro view of transition that shows the shift from locally owned resources to shared and virtual resources is depicted in the diagram below.

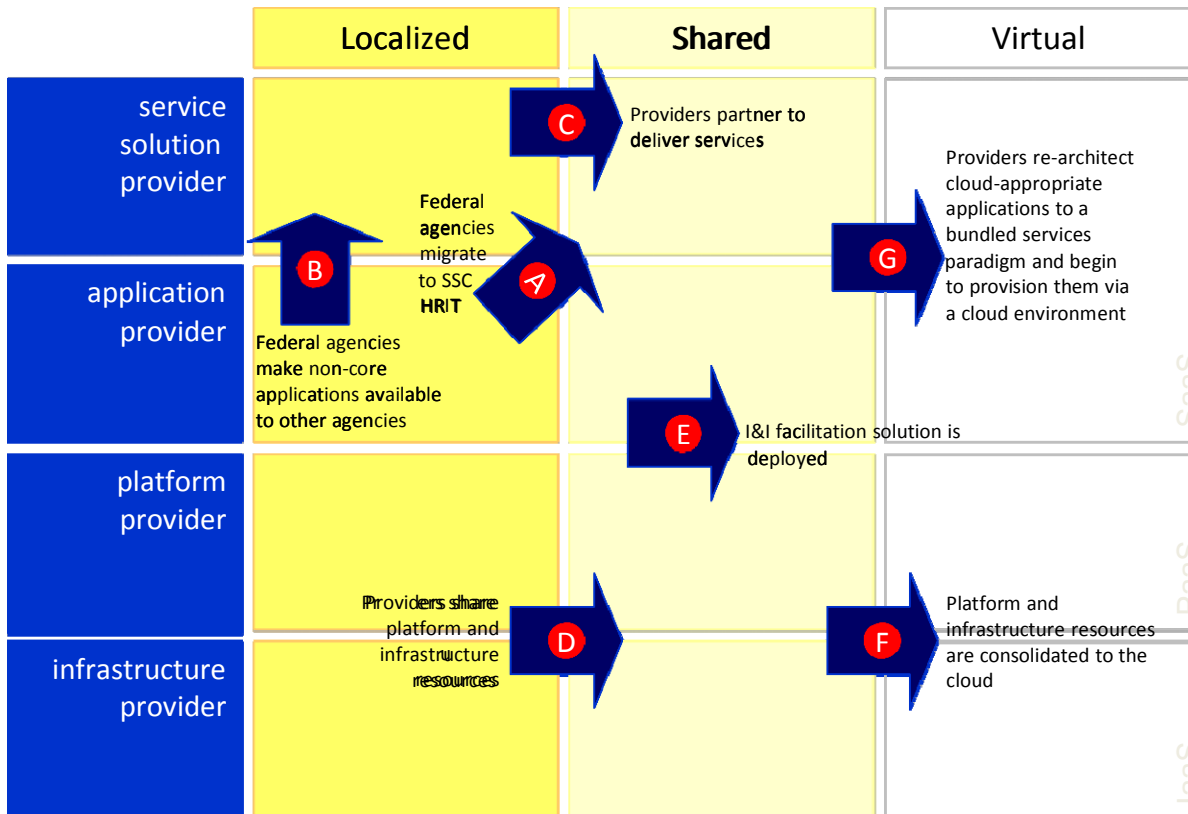


Figure 7 – Transition Activities

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Neither the A-through-G lettering nor the left-to-right placement of the transition patterns in the above diagram is meant to imply strict sequencing or dependency. Generally speaking, these patterns can occur somewhat simultaneously. There are some important timing considerations, however:

- Since Federal cloud strategies are just now being conceived and deployed and cloud offerings are consequently currently quite limited, agencies should accelerate the move toward shared resources – without waiting for cloud issues to be resolved and cloud services to be ubiquitously available.
- Moving to a shared delivery mode is not a prerequisite to moving to a virtual mode; agencies can move directly from localized resources to cloud-based services.
- Since interoperability is a prerequisite to virtual services, deploying the I&I facilitation solution (E) is a prerequisite to providing SaaS (G).
- Consolidation of platform and/or infrastructure resources and virtualization of platform and infrastructure services (F) can happen concurrently with the development and implementation of I&I facilitation solution (E).
- IaaS and PaaS (F) are prerequisites for providing SaaS (G).
- The bulk of the IT transition activity to date has been in the IaaS layer, which makes it easy to move existing applications running in general purpose operating systems into virtual machines to virtualize them. After the initial transition to IaaS, however, the additional advantages of PaaS and SaaS begin to motivate a retargeting of applications to those higher layers.

The seven transition activities are described below.

- A. Federal agencies migrate to SSC HRIT. Federal agencies that have not migrated core HRIT to a shared Service Center follow HR LOB migration planning guidance to evaluate, select, and migrate to an HR LOB-endorsed SSC for core services. Agencies migrate non-core functions to SSCs and, where it makes sense, sunset their legacy non-core HR applications.
- B. Federal agencies make non-core applications available to other agencies. Federal agencies work with the HR LOB Innovation Center to share information about those applications that have potential for meeting other agencies' needs. SSC(s) and the agency application provider identify opportunities to partner in offering an application to the SSC's customers. The SSC and / or the application provider modify the application as necessary for scalability and unique business requirements. The SSC integrates, interoperates, or interfaces the application to the SSC's services portfolios. The SSC and application provider negotiate management and measurement processes (e.g., memoranda of understanding, service level agreements). SSCs market these services as part of their services portfolio. The application may be operated, maintained by the SSC, the application provider, or cooperation between the two.
- C. Providers partner to deliver services. SSCs work with the HR LOB Innovation Center and with other SSCs to identify opportunities for services partnerships, including non-

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core HR/HCM applications, back office services, and licensing agreements. The SSC partners work together to interoperate or interface the applications. The SSC partners negotiate management and measurement processes. SSCs market these services as part of their services portfolio. The service may be delivered by one of the SSCs or through some cooperative arrangement between the two.

- D. Providers share platform and infrastructure resources. Infrastructure owners and platform software owners identify excess capacity and/or potential opportunities for sharing resources. Infrastructure owners and platform software owners reach out to SSCs and to the HR LOB Innovation Center to seek partnership opportunities. Partners negotiate management and measurement agreements. The provider makes platform resources available per agreements.
- E. I&I facilitation solution is deployed. A limited number of providers (or one provider) offer a facility that accomplishes interoperability across multiple disparate applications and application environments. The provider builds out this capability based on HR LOB standards for interoperability and using the governmentwide HR data model as the blueprint for the metadata dictionary that underlies the facility and drives the data exchange. The provider enables this capability to shared HR/HCM applications and services, to virtual HR/HCM services, and as appropriate to other I&I facilities.
- F. Platform and infrastructure resources are consolidated to the cloud. Platform and infrastructure providers deploy virtual capability. The provider adopts usage management processes and enabling technology for virtual services management. The provider markets these services directly to SSCs and via the HR LOB Innovation Center. The provider negotiates management and measurement processes with the customer and makes resources available per agreements. (Note: current HR applications that depend on specific pieces of hardware [meaning they expect to see a certain type of network controller or disk] require special consideration; the PaaS provider is not likely to have this older hardware in its infrastructure. By utilizing PaaS, virtual machines, storage, and the network are pre-configured by the provider. Furthermore, the PaaS providers monitor the virtual machines for failures and initiate auto-recovery when needed.)
- G. Providers provision cloud-appropriate services in a cloud environment. Providers re-architect cloud appropriate applications into bundled services and begin to provision them via a private Federal cloud environment. The virtual services provider adopts usage management processes and enabling technology for virtual services management. The virtual services provider markets these services directly to customers and via the HR LOB Innovation Center. The virtual services provider negotiates management and measurement processes with the customer. The virtual services provider makes services available per agreements.

To help guide agencies in their movement toward cloud computing, OMB provides a Federal Cloud Computing Strategy. Section II of this strategy describes a decision framework to support

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agencies as they make decisions about their IT services delivery mode. The OMB framework describes the following overall approach for moving toward virtual services:

1. **Select.** Identify which IT services to move to which mode and when. Identify sources of value for migrations: efficiency, agility, innovation, etc. Determine migration readiness.
2. **Provision.** Aggregate demand to the agency level where possible. Ensure interoperability. Contract effectively to ensure agency needs are met. Realize value by repurposing or decommissioning legacy assets and redeploying freed resources.
3. **Manage.** Shift IT mindset from assets to services. Build new skill sets as required. Actively monitor SLAs to ensure compliance and continuous improvement. Reevaluate vendor and service models periodically to maximize benefits and minimize risks.

4.2 Next Steps

Because of the investment required to shift to shared and virtual delivery modes and the relative immaturity of cloud capability and standards, the shift to shared and virtual resources is a long term proposition. However, there are activities that SSCs and agencies can begin to do immediately to establish momentum toward HRIT resource sharing.

1. **Promote communication and information-sharing.** The HR LOB will work with stakeholder agencies – providers and customers – to share information about HRIT portfolios and plans, facilitating the kind of information-sharing that will lead to resource sharing.
2. **Establish the HR LOB Innovation Center.** The Innovation Center will help establish a community of HRIT subject matter experts that will serve as the communication hub for the information-sharing described above. It will also provide for a sandbox environment that allows for demonstrating and accessing the HR applications that may be shared.
3. **Perform an HRIT current state analysis.** The HR LOB will leverage the results of the HRIT inventory effort that took place during 4QFY2011 to analyze existing portfolios for resource sharing opportunities.
4. **Develop a transition plan.** The seven activities that appear in Figure 7 form a macro view of the transition toward shared and virtual resources. The realization of this framework will involve numerous activities – many of which have dependencies and/or must be coordinated with other activities – and it will involve effort on the part of many people – at the provider level, at the customer level, at the policy level, and at the program level. The HR LOB will work with SSCs and agencies to understand their plans regarding transition patterns one through seven above and over time develop a coordinated plan for realizing the framework.

5 Funding Strategy

A key component of the shared services concept – and one of four goals of the HR LOB – is significant cost savings and/or cost avoidance. This may be achieved by standardizing business processes and then consolidating some business services and supporting technology to shared service centers – shifting from localized resources to shared and virtual resources. Significant cost savings can be achieved through the resulting reduction in locally-owned, duplicative software, hardware, operations, and labor resources. Some of those savings, then, can and should be reinvested to update and modernize technology – which will lead to process efficiencies, improved customer service, and enhanced strategic management of the HR function.

The level of modernization of HRIT has fallen significantly behind agency business needs and expectations. The four payroll systems that calculate and issue paychecks for over 99% of today’s Federal workforce range in age from 14 years to 28 years. Having been continually modified over the years to support new and revised legislation, policy, and regulations, these systems are increasingly difficult to maintain. Numerous business process workarounds exist that make working with the systems cumbersome and inefficient. Providers have implemented payroll system sustainment strategies and are successfully maintaining their continuity of operations with minimal issues that directly impact the personal lives of Federal employees. However, the risk of catastrophic payroll system failure only increases over time.

Sufficient modernization funding, however, is not available. No portion of the savings resulting from the consolidation of HR and payroll services is being reinvested in the modernization that could produce these benefits and avoid the risks. Additionally, providers for the most part operate within legislative constraints that prohibit them from acquiring funding to modernize their systems. This section provides some background on current funding approaches and offers some recommendations for new funding approaches that could help make these investment dollars available.

5.1 Current State of HRIT Funding

The HR shared service centers and OPM governmentwide applications are funded through a combination of fees collected from their customers, often paid out of working capital funds (WCF), and some direct appropriations. For the most part, the transfers of these funds are governed through the Economy Act (31 U.S.C. § 1535) which regulates interagency transfer and requires that funds paid during a given year are expended during that year.

The table below shows the funding mechanisms for the HR LOB public SSCs.

Provider	Funding Source
DOD (CPMS)	Direct Appropriation
DOD (DFAS)	Working Capital Fund
DOI (NBC)	Working Capital Fund

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GSA	Working Capital Fund
HHS	Working Capital Fund
Treasury (BPD)	Franchise Fund
Treasury (HR Connect)	Working Capital Fund
USDA (NFC)	Working Capital Fund

Table 3 – HR LOB Public SSC Funding

Current funding mechanisms place very real constraints around providers’ ability to collect funds for capital investments and to fund modernization initiatives:

- Providers are required to charge only for actual costs incurred (due to the Economy Act).
- Providers cannot charge their customers extra and build up a reserve for upgrades and modernization projects.
- Working Capital Funds typically do not allow money to be carried over from one year to the next.
- Only a limited number of Federal agencies are granted permission to establish a Franchise Fund to retain a reasonable reserve⁸.
- Agencies (customers) must have the full amount available in their account to obligate funds toward a contract (Anti-deficiency Act⁹).

These constraints create serious challenges for the providers. There are no dollars available to fund modernization, unless the provider can sufficiently increase customer fees or the parent agency can obtain funds from appropriations. Increasing customer fees to fund major capital investments and modernization efforts is not feasible because of the magnitude of the increase that would be required and the necessity to collect and spend the funds during a single fiscal year. And parent agencies are more focused on funding the agencies’ missions than on funding back office services, even if those services are shared. Providers are thus forced to perpetually defer major technology upgrades or replacements. This model is not sustainable.

5.2 Funding Recommendations

The HR LOB must move toward a more sustainable model in which providers are able to acquire funding for necessary modernization efforts. The following recommendations are proposed to achieve this model.

1. Work with OMB and Congress to create legislation that will grant HR LOB Shared Service Centers the authority to establish no-year Franchise Funds. This will allow providers to retain a

⁸ <http://www.gao.gov/special.pubs/appforum2005/transactions.pdf>

⁹ “The fiscal principles underlying the Antideficiency Act are really quite simple. Government officials may not make payments or commit the United States to make payments at some future time for goods or services unless there is enough money in the "bank" to cover the cost in full. The "bank," of course, is the available appropriation.” <http://www.gao.gov/ada/antideficiency.htm>

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portion of the fees that they collect from customer charges and apply them to development, modernization, and enhancements (DM&E). While this will not be sufficient to pay for major modernization efforts, it will allow for a reasonable sum to fund version upgrades and small to moderate maintenance or enhancement projects.

2. Reinvest a portion of the savings resulting from shared resources in HRIT modernization that will lead to addition savings. Put mechanisms in place to track and report on dollar benefits achieved as a result of HR LOB-sponsored consolidation of HRIT and services. Allocate a percentage of those savings to providers' modernization efforts.

3. Encourage HR LOB SSCs to maximize resource sharing and consolidation of services. Identify synergies and opportunities for partnering among providers, including sharing infrastructure, platform, and application resources. Explore consolidation of requirements and contract vehicles to maximize leverage on vendors, further reducing costs and potentially increasing value for the Federal government.

4. Consider consolidating HR applications and going further to consolidate SSC organizations, where it makes sense. IT consolidation will result in fewer systems to modernize, significantly reducing the cost of modernization. Organizational consolidation will create larger customer bases, resulting in lower per-seat costs that providers charge to customers.

The above recommendations are wide-reaching and complex, requiring numerous changes to legislation, policy, and business practices. The time and effort needed to achieve them will be quite significant. There are, however, some actions that can be pursued in the shorter term to mitigate funding challenges. OMB's 25 Point Implementation Plan to Reform Federal IT provides a basis for some short-term recommendations. In the document, the U.S. CIO acknowledges that "the rapid pace of technological change does not match well with the Federal government's budget formulation and execution processes." OMB proposes some actions that will better align the budget process with the technology cycle. They are summarized below.

Work with Congress to develop IT budget models that align with modular development. Agency CIOs and CFOs will identify pilot programs at several agencies for which added budget flexibility could save money and improve outcomes. OMB and agencies will work with Congress to develop proposed budget models to complement the modular development approach. OMB will work with Congress to analyze existing working capital funds (WCFs) and other vehicles for pooling funds and extending availability of funding. This analysis will:

- Address limits on the amount of funding that could flow through such accounts under current law across all appropriations and agencies, any limits on the types of activities that may be funded, and any other limitations on the use of transfer authorities to feed such accounts from contributing accounts.
- Include a comprehensive review of the legislative language for accounts receiving funds and the legal limits on use of general transfer authorities.
- Identify examples of the use of the existing funding flexibility vehicles for IT projects, develop best practices guidance on applicability and implementation across the

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government, and identify where skill gaps exist in developing costing models and managing funds.

Develop supporting materials and guidance for flexible IT budget models. To support agencies and appropriations staff in leveraging budget flexibility, the Federal CFO Council, in collaboration with the Federal CIO Council, will develop a set of best practices and materials that explain the need for these types of funding and prescribe a path to achieving more flexible models.

Work with Congress to scale flexible IT budget models more broadly. OMB will engage several agencies to work with Congress to launch flexible IT budget models where appropriate. As pilot agencies demonstrate success with flexible IT budget models on selected programs, OMB will continue to work with Congress to scale flexible budget models across major IT programs governmentwide.¹⁰

Given this guidance, HR LOB will work with OMB to:

1. Understand the results of their funding analysis and its potential for HRIT funding.
2. Identify HRIT projects that are viable pilot projects for the new budget model(s). Work with OMB to understand the pilot proposal process and provide support to pilot project sponsors in proposal development and submission.
3. Serve as a knowledge center, helping to fill knowledge gaps and providing counseling on OMB's prescribed path and practices for achieving more flexible models.
4. Accumulate lessons learned and make them available to HRIT projects and to OMB for more widespread application.

The above funding-related activities could be part of the role of the HR LOB Innovation Center.

¹⁰ U.S. Chief Information Officer. "25 Point Implementation Plan to Reform Federal Information Technology Information Management".

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Appendices

Appendix A: Additional Information

Cloud Computing

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

The cloud computing model promotes availability and is comprised of five essential characteristics, three service models, and four deployment models.

Essential Characteristics

- On-demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service

Service Models

- Cloud Software as a Service (SaaS)
- Cloud Platform as a Service (Paas)
- Cloud Infrastructure as a Service (IaaS)

Deployment Models

- Private cloud
- Community cloud
- Public cloud
- Hybrid cloud

NIST Special Publication 800-145 – This NIST definition of cloud computing contains the details of essential characteristics, service models, and deployment models of cloud computing.

Cloud computing is a relatively new way of referring to the use of shared computing resources, and it is an alternative to having local servers handle applications. Cloud computing is a way of managing large numbers of highly virtualized resources and control the delivery of services on these to meet the user consuming model requirements while allowing elastic scaling and cost reduction. The key characteristic of a cloud is that the user does not have to own the resources required to deliver the service. Services are delivered by the Cloud as a commodity. In a sense it is very similar to electricity. The user does not have to know how electricity is produced; it is just delivered to the user's location by the network of an electricity distributor and it is available when needed.

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Cloud computing groups together large numbers of compute servers and other resources and typically offers their combined capacity on an on-demand, pay-per-cycle basis. The end users of a cloud computing network usually have no idea where the servers are physically located – they just spin up their application and start working. Cloud architecture is an architecture built with commodity hardware and virtualization.

Services are segmented in three layers where infrastructure, platforms or software is being provisioned. Therefore, components of cloud computing include dynamic delivery of IT services in the form of applications (Software as a Service), platform services (Platform as a Service) and infrastructure services (Infrastructure as a Service). A key aspect in cloud computing is that customers do not buy the software application, platform, and underlying infrastructure. Instead, they can lease the cloud computing services temporarily and then return them. The three blocks – SaaS, PaaS and IaaS – should not be looked at in isolation: they have mutual interrelationships that have to be taken into account in forming business models.

To support the Federal Cloud Computing Direction and Deployment Approach, the ITI Line of Business PMO has been refocused as the Cloud Computing PMO.

Federal Identity, Credential, and Access Management (FICAM) Guidance

The goal of the Identity, Credential, and Access Management Subcommittee (ICAMSC) of the CIO Council is to establish a consolidated approach for all government-wide identity, credential and access management activities and thus promote alignment, clarity, and interoperability. The ICAMSC has developed guidance for Federal agencies to provide agencies with architecture and implementation guidance that addresses existing ICAM concerns and issues they face daily. The benefits associated with implementation of ICAM are summarized below:

- Increased security, which correlates directly to reduction in identity theft, data breaches, and trust violations. Specifically, ICAM closes security gaps in the areas of user identification and authentication, encryption of sensitive data, and logging and auditing.
- Compliance with laws, regulations, and standards as well as resolution of issues highlighted in GAO reports of agency progress.
- Improved interoperability, specifically between agencies using their PIV credentials along with other partners carrying PIV-interoperable² or third party credentials that meet the requirements of the federal trust framework. Additional benefits include minimizing the number of credentials requiring lifecycle management.
- Enhanced customer service, both within agencies and with their business partners and constituents. Facilitating secure, streamlined, and user-friendly transactions – including information sharing – translates directly into improved customer service scores, lower help desk costs, and increased consumer confidence in agency services.
- Elimination of redundancy, both through agency consolidation of processes and workflow and the provision of government-wide services to support ICAM processes.

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This results in extensibility of the IT enterprise and reduction in the overall cost of security infrastructure.

- Increase in protection of personally identifiable information (PII) by consolidating and securing identity data, which is accomplished by locating identity data, improving access controls, proliferating use of encryption, and automating provisioning processes.

The National Information Exchange Model

The National Information Exchange Model (NIEM) is a local, state, tribal, and Federal interagency initiative providing a foundation for seamless information exchange. NIEM is a framework to:

- Bring stakeholders and communities of interest (COIs) together to identify information sharing requirements in day-to-day operational and emergency situations
- Develop standards, a common lexicon, and an online repository of information exchange package documents to support information sharing
- Provide technical tools to support development, discovery, dissemination, and reuse of exchange documents
- Provide training, technical assistance, and implementation support services for enterprise-wide information exchange

NIEM is a mechanism to facilitate the standardization of data exchanged between disparate systems. It is an object-oriented data model instantiated as XML schema that is composed of reusable components and is designed to facilitate disparate government and private entities in exchanging information quickly, accurately, and reliably. The NIEM architecture allows information to be modeled using components within NIEM and from external standards, with both types of components being usable side by side.

NIEM provides reusable components and Information Exchange Package Documentation (IEPD) for exchanges across NIEM domains. An IEPD is a complete definition of an Information Exchange Package (IEP). It is generally composed of schemas (for data exchange) and documentation (for understanding the business context and usage).

Service Oriented Integration

Service-oriented integration (SOI) integrates computing entities using only service interactions in a service oriented architecture. Service oriented integration addresses problems with integrating legacy and inflexible heterogeneous systems by enabling IT organizations to offer the functionality locked in existing applications as reusable services. SOI is the application of service oriented architecture principles to build an integration facility. This integration facility does not have to be part an SOA, but implementing an SOI style integration layer provides a good foundation for implementing an SOA.

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There are several important aspects of SOI. SOI is an architectural style that requires a service provider, a service requester, and a service description. It is also a set of architectural principles, patterns, and criteria that address characteristics such as modularity, encapsulation, loose coupling, reuse, and compos-ability.

SOI can be used to integrate both SOA and non-SOA applications. When SOI is used to integrate non-SOA applications, business functions are exposed as services using the service adapter pattern. Additionally, SOI does not require an enterprise-wide transformation – SOI can be implemented in individual projects and will show business benefit.

After SOI has been adopted, an organization can begin incrementally adopting SOA. Once established, SOI lowers the cost to add new interfaces and to modify existing interfaces. New interfaces are easier to add because an established SOI implementation has a reusable base of integration services. Existing interfaces are easier to modify because SOI separates the areas that change from the base of integration services. Because SOI can be implemented over a variety of integration middleware products, it probably can start with software that an organization already owns. Additionally, SOI can leverage existing infrastructure without requiring an infrastructure “rip-and-replace”.

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Appendix B: List of Federal Standards, Mandates, Guidelines, and Directives

Executive Branch Standards, Directives, and Guidance

- E-Gov directives,
- OMB's passback requirements for FY 2011
- OMB Circular A-130, Federal Transition Framework (FTF)
- Federal Enterprise Architecture (FEA) Guidance from the Office of Management and Budget (OMB) including Circulars A-11, A-127, and A-130
- Homeland Security Presidential Directive 12 (HSPD-12): Policy for a Common Identity Standard for Federal Employees and Contractors
- OMB Memoranda (M 04-04, M 05-24, M 06-16, and M 07-16)

Congressional Legislation, Standards and Directives

- Information Technology Management Reform Act of 1996 (Clinger-Cohen),
- the E-Government Act of 2002,
- the Government Performance Results Act of 1993 (GPRA),
- EA maturity assessments performed by the Government Accountability Office (GAO) and OMB.
- Federal Information Security Management Act (FISMA) of 2002
- Privacy Act of 1974

Federal Identity, Credential, and Access Management (FICAM) Roadmap and Implementation Guidance

Enterprise Architecture Segment Report (EASR), Interim Version 1.3, September 2009, OMB

National Information Exchange Model (NIEM)

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Appendix C: Glossary

Term	Definition
Access Control	The service component that allows HR LOB a set of capabilities that support the management of permissions for logging onto a computer or network.
Application Program Interface (API)	Set of rules and specifications that software programs can follow to communicate with each other. It serves as an interface between different software programs and facilitates their interaction, similar to the way the user interface facilitates interaction between humans and computers.
Business Reference Model (BRM)	An architectural model that describes the HR LOB from a functional perspective in terms of functions, sub-functions, and business processes.
Change Management	The set of capabilities that control the process for updates or modifications to the existing documents, software or business processes within HR LOB solution.
Cloud Computing	The computing paradigm in which IT-related capabilities are provided “as a service”, allowing users to access technology-enabled services from the Internet ("in the cloud") without knowledge of, expertise with, or control over the technology infrastructure that supports them.
Concept of Operations (CONOPS)	A document describing the characteristics of a proposed system from the viewpoint of an individual who will use that system. It is used to communicate the quantitative and qualitative system characteristics to all stakeholders.
Conceptual Architecture	The abstraction for a domain (Enterprise, or Organization, or Line of Business, or Solution) that identifies the architecture components such as processes, services, and data and interconnections between these components at conceptual level without logical and operational details.
Configuration Management	The set of capabilities that control the hardware and software environments, as well as documents within HR LOB solution.
Content Management	The service component that creates, revises, and manages content regarding policy, business rules, processes etc. for publication into the knowledge base.
Cross-cutting Service Components	Service components that allow the collaborative usage across organizations, lines of businesses and domains.
Data Model (DM)	An architectural model that describes how data is represented and accessed. It formally defines data objects and relationships among data objects for a domain of interest.

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Distributed Management Task Force (DMTF)	The organization bringing the IT industry together to collaborate on systems management standards development, validation, promotion and adoption.
Enterprise Information System (EIS)	Any kind of computing system that is of "enterprise class". This means typically offering high quality of service, dealing with large volumes of data and capable of supporting some large organization ("an enterprise").
Enterprise Service Bus (ESB)	A software architecture model used for designing and implementing the interaction and communication between mutually interacting software applications in Service Oriented Architecture. Its primary use is in Enterprise Application Integration of heterogeneous and complex landscapes.
Federal Enterprise Architecture (FEA)	A collection of inter-related "reference models" designed to facilitate cross-agency analysis and opportunities for collaboration. The FEA reference models can be easily integrated along business lines, providing a foundation for Component-Based Architecture design.
Federal Identity and Access Management (FICAM)	Set of documents that provide the Federal Government with standardized controls around identity and access management. FICAM Roadmap and Implementation Guidance ¹¹ document provides agencies with architecture and implementation guidance that addresses existing ICAM concerns. This document presents the Federal Government with a common framework and implementation guidance needed to plan and execute ICAM programs.
Franchise Funds	Funds that are government-run, self-supporting businesslike enterprises managed by federal employees. Franchise funds provide a variety of common administrative services, such as payroll processing, information technology support, employee assistance programs, public relations, and contracting.
Infrastructure as a Service (IaaS)	The capability provided to the consumer to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run software such as operating systems and network applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls).

¹¹ Federal Identity, Credential, and Access Management (FICAM) Roadmap and Implementation Guidance Version 1 – CIO Council, November 2009

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Integration Services	The software services that enable elements of distributed business applications to work as one unit. These elements can share function, content, and communications across heterogeneous computing environments. In particular, service integration offers a set of architecture services such as platform and service location transparency, transaction management, basic messaging between two points, and guaranteed message delivery.
Interoperability Services	The software services that define the capabilities of discovering and sharing data and services across disparate systems and vendors.
Innovation Center	A place, a forum, and a resource center dedicated to developing and testing ideas for business and technology. It is an enriching environment where sharing space, business basics and collaborative creativity will cultivate new ideas, transforming them into reality.
Lightweight Directory Access Protocol (LDAP)	An application protocol for accessing and maintaining distributed directory information services over an Internet Protocol (IP) network. LDAP is both an information model and a protocol for querying and manipulating it. It is an open industry standard that defines a standard method for accessing and updating information in a directory.
Local Area Network (LAN)	A computer network that interconnects computers in a limited area such as home, school, computer laboratory or office building.
Message Oriented Middleware (MOM)	Software or hardware infrastructure supporting sending and receiving messages between distributed systems. MOM allows application modules to be distributed over heterogeneous platforms and reduces the complexity of developing applications that span multiple operating systems and network protocols. The middleware creates a distributed communications layer that insulates the application developer from the details of the various operating system and network interfaces.
Performance Model (PM)	An enterprise architectural model that articulates the linkage between internal business components and the achievement of business and customer-centric outputs.
Plug and Play	Describes a computer's ability to have new devices, normally peripherals, added to it without having to reconfigure or load device drivers for the new card. This term is also used in the software industry to describe how applications, services and other software-based applications can be swapped in and out with little or no reconfiguration to existing applications.

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Quality of Service (QoS)	A method to guarantee a bandwidth relationship between individual applications or protocols. Quality of service is the ability to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow. The QoS is also defined as the set of techniques to manage network resources.
Service Component Model (SCM)	An enterprise architectural model that identifies and classifies horizontal and vertical service components supporting Federal agencies and their IT investments and assets. It also defines how these services are delivered to the user.
Service Data Objects (SDO)	A technology that allows heterogeneous data to be accessed in a uniform way in a service-oriented architecture. The SDO specification was originally developed in 2004 as a joint collaboration between BEA and IBM and approved by the Java Community Process. SDO offers a convenient way to work with XML documents.
Service Level Agreement (SLA)	A negotiated agreement between two parties, where one is the customer and the other is the service provider. It is part of a service contract where the level of service is formally defined. In practice, the term SLA is sometimes used to refer to the contracted delivery time (of the service) or performance. The SLA records a common understanding about services, priorities, responsibilities, guarantees, and warranties.
Service Oriented Integration (SOI)	An architectural style which requires a service provider, a service requester, and a service description. SOI is a set of architectural principles, patterns, and criteria which address characteristics such as modularity, encapsulation, loose coupling, separation of concerns, reuse, and compose-ability. SOI is also a programming model with tools and technologies, such as Web Services.
Software as a Service (SaaS)	The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser (e.g., web-based email). The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.
Stateless Service	A service is stateless when it is not consuming memory related to the temporary storage and processing of state data. Whether or not a service enters into a stateless condition is determined by the functionality of the service capability that was invoked.

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Technical Model (TM)	An enterprise architecture component that is a component-driven, technical framework. The TM categorizes the standards and technologies to enable and support the delivery of service components and capabilities. It also unifies existing agency technical models and E-Gov guidance by providing a foundation to advance the reuse and standardization of technology and Service Components from a governmentwide perspective.
Virtualization	The creation of a virtual (rather than actual) version of something, such as a hardware platform, operating system, a storage device or network resources.
Virtual Private Network (VPN)	A method of computer networking – typically using the public internet – that allows users to privately share information between remote locations, or between a remote location and a business' home network.
eXtensible Markup Language (XML)	A set of rules for encoding documents in machine-readable form. It is a computer language for describing information and exchanging information between computer systems.
XML Payload	The XML document containing the essential data that is being carried within a packet, or a message protocol.